Progress Report

December 9, 2015

Steam Enhanced Extraction at the Former Williams AFB, ST012 Site

Mesa, AZ

TERRATHERM

1. Summary

This report covers the period of operations from Tuesday, December 1, 2015 through Monday, December 7, 2015. The following table provides a summary of the project operational status.

Table 1. Project Summary

	Value	Unit
Target Treatment Zone (TTZ) Soil Volume	410,000	cubic yards (cy)
Area	199,000	square feet (ft^2)
Upper Depth of Treatment	145	feet (ft) below ground surface (bgs)
Lower Depth of Treatment	245	ft bgs
Vapor Liquid Treatment Started	09/29/14	
Thermal Operations Started	09/29/14	
Last Process Data Update	12/07/15	
Last Temperature Data Update	12/07/15	
Estimated Total Days of Operation	422	days
Days of Operation	434	days
Days of Operation vs. Estimate	103	percent (%)
Estimated Total Energy Usage	11,343,000	kilowatt hours (kWh)
Total Energy Used	4,358,033	kWh
Used Electrical Energy vs. Estimate	38	%
Total Steam Injected	269.7	million pounds (lbs)
Projected Total Steam Injection	320	million lbs
Steam Injected Vs Projected	84	%
Total Mass Removed in Vapor Based on Photoionization Detector (PID) Readings	966,781	lbs
Total Mass Removed as NAPL	1,166,950	lbs
Average Daily NAPL Mass Removal Last Week	1,691	lbs/day
Total Vapor and Liquid Mass Removal (based on PID readings)	2,133,730	lbs
Average Power Usage Rate Last Week	476	kilowatts (kW)
Average Wellfield Vapor Extraction Rate Last	449	standard cubic feet per minute (scfm)
Average Condensate Production Rate Last Week	0.3	gallons per minute (gpm)
Average Water Extraction Rate Last Week	98	gpm
Total Water Extracted	66,820,027	gallons
Total Recovered Light Non-Aqueous Phase Liquid	177,618	gallons
Average Water Discharge Rate Last Week	115	gpm
Total Treated Water Discharge	88,077,000	gallons

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Operational highlights from the past week include:

- On Tuesday, December 1, 2015 the City of Mesa (COM) informed Amec Foster Wheeler (Amec FW) that discharge from the ST012 site could be initiated again. The liquid system was restarted in the morning.
- After documenting steady extraction rates for two days, steam injection was restarted as well at a low rate on December 3, 2015, by heating up the injection wells. By December 4, 2015, the steam system was at a capacity of injecting close to 40,000 lbs/hr.
- A few steam injection wells in the Cobble Zone (CZ), Upper Water Bearing Zone (UWBZ) and Lower Saturated Zone (LSZ) was left at a lower injection rate in preparation of a pump maintenance event scheduled for the week of December 7, 2015. Also selected wells along the perimeter were kept at a low injection rate.
- The average liquid extraction rate from the formation was approximately 98 gpm for this operational period as the eductor system was only operational for a part of this operational period.
- The average steam injection rate in the LSZ was 13,900 lbs/hr (or 27.8 gpm).
- The average steam injection rate in the UWBZ was 7,600 lbs/hr (or 15.2 gpm).
- The average steam injection rate in the CZ was 6,000 lbs/hr (or 12.0 gpm).
- The average steam injection rate as water for all zones was 55 gpm.
- The net extraction from the formation was 43 gpm (approximately 1.8 times the water volume injected as steam was extracted as water).
- Collected process, wellfield and laboratory data per the sampling schedule, except from parts of the system affected by the shutdown.
- Conducted regular maintenance on the treatment system.
- The following MPE wells were identified as requiring maintenance during this operational period:
  - UWBZ-2*
  - UWBZ-27
  - LSZ-5*
  - LSZ-14
  - LSZ-37
  - CZ-11

**Temperatures at these MPE wells are at boiling – well maintenance will be postponed until temperatures are below boiling due to health and safety concerns.*

- Amec Foster Wheeler closed SVE-01M to vapor extraction due to high temperatures, reduced flow, and the presence of liquids and biomass in the extraction pipe. The bottom of the well was sounded and found to be deeper (~138.5 ft bgs) than records indicate (128 ft bgs).

2. Vapor Extraction

Figure 1 below shows the vapor extraction rate from the site. Note that the estimated steam extraction rate is a calculated value based on the water generated at the moisture separators after cooling the vapors from the wellfield. Based on energy balance analysis, additional steam is likely being pulled into and condensing in the liquid extraction system. This steam extraction is not measureable and not accounted for in Figure 1. Additionally the wellfield flow is calculated as the difference between the air stripper flows and thermal accelerator influent, and is therefore only an estimate.

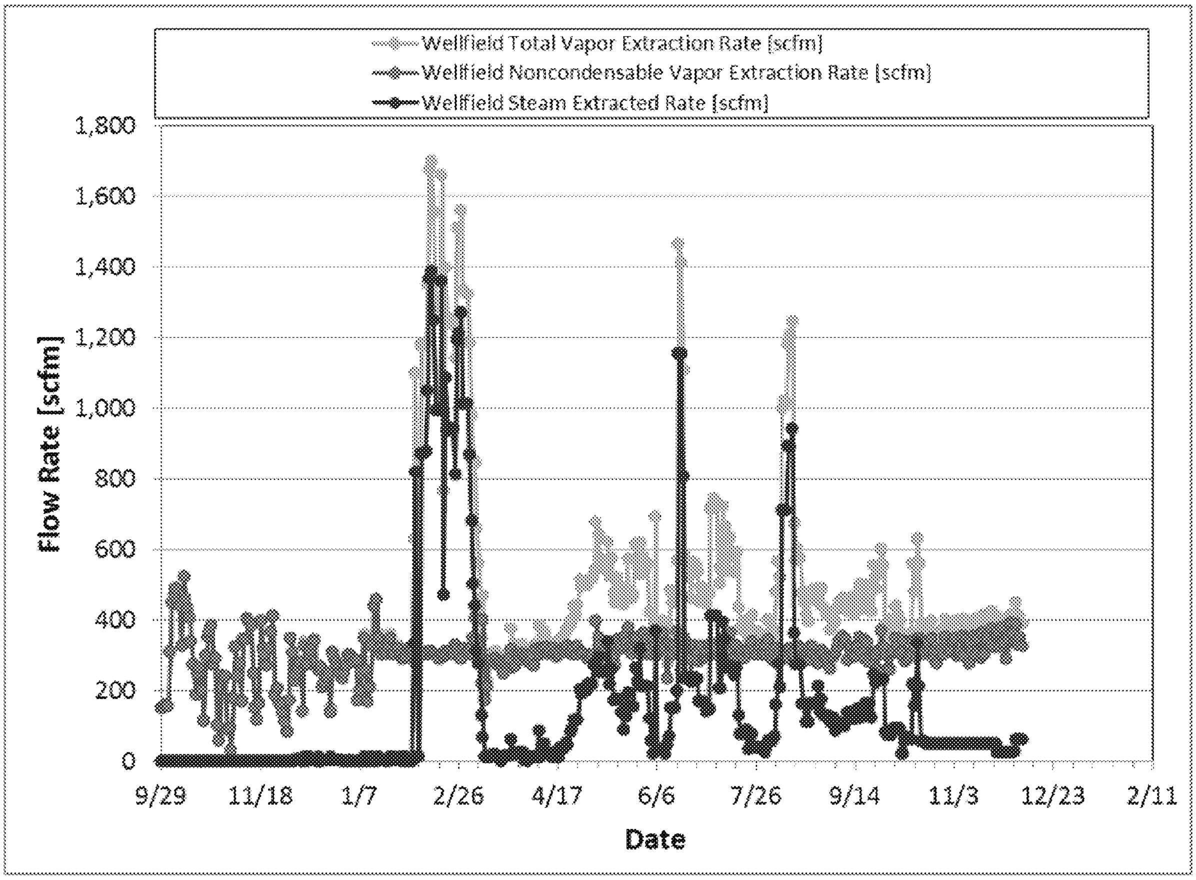

Figure 1. Vapor Extraction Rate

Note: Well SVE01M was tied into the SEE extraction system on June 5, 2015. Wells SVE10M and SVE14M were tied into the SEE extraction system on September 23, 2015.

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3. PID Measurements

The following figure depicts the PID concentrations from the wellfield effluent to the effluent of the thermal accelerators collected since the start of operations. Note that PID readings of 0.0 parts per million by volume (ppmV) are shown in the figures as 0.01 ppmV due to the logarithmic scale that does not allow display of 0-values. Accelerator influent readings are interpolated for days where no data is collected, since the value is used in the mass removal calculation.

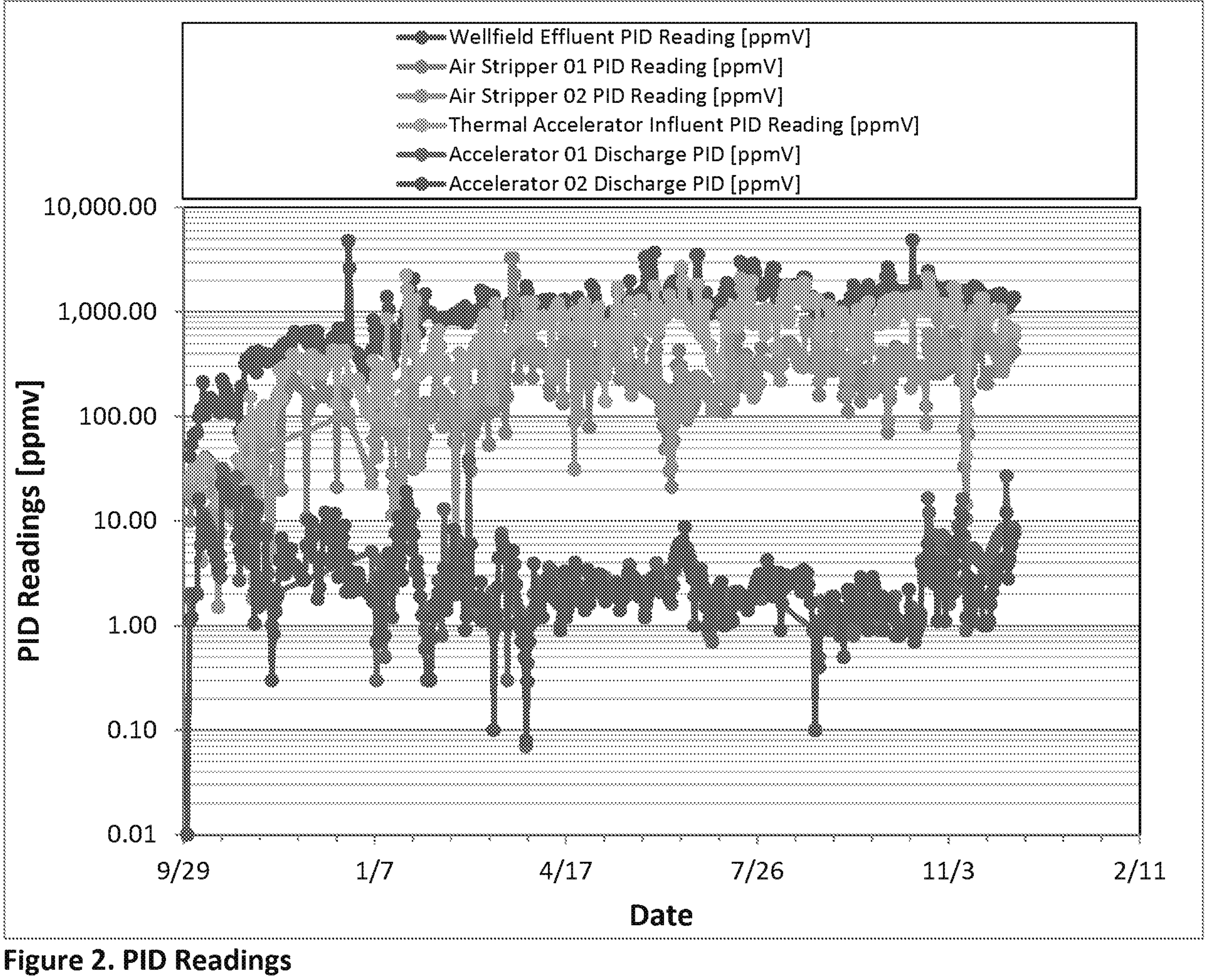

Figure 2. PID Readings

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4. Mass Removal

The mass removal is calculated based on the PID and laboratory data collected at the thermal accelerator influent and the LNAPL recovered. The figure also depicts the mass removed based on PID and laboratory data.

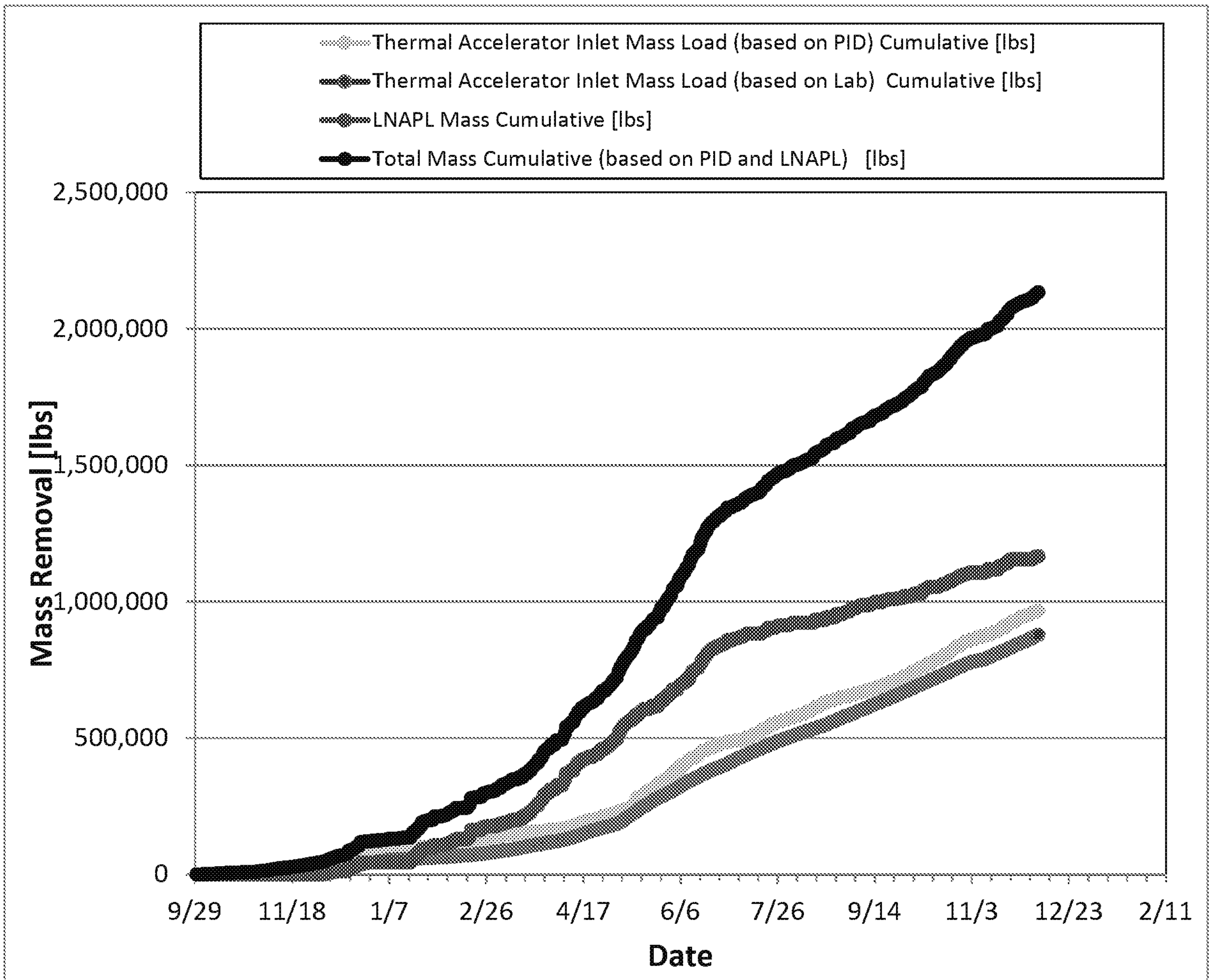

Figure 3. Mass Removal

Note: A NAPL density of 6.57 lbs/gallons was used to convert the NAPL volume to pounds. A molecular weight of 106,168 g/mol (corresponding to xylene) was used to convert PID readings to concentrations.

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5. Daily Mass Removed

Figure 4 outlines the daily mass removed as vapor and LNAPL. The total daily mass removed is the combination of vapor and LNAPL. The liquid mass removal is captured in the vapor phase due to the volatilization of liquid contaminants in the air strippers.

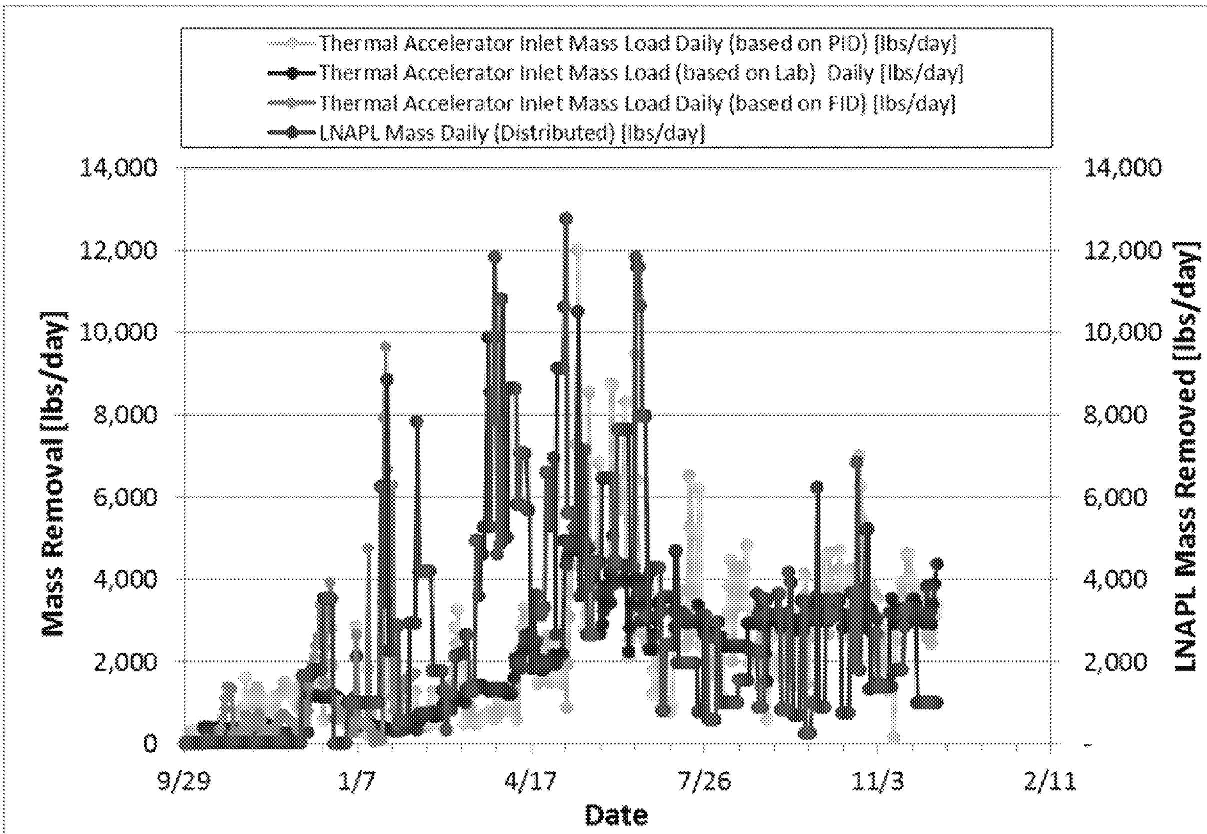

Figure 4. Daily Mass Removed

Note: Laboratory data are not collected daily. The "Thermal Accelerator Inlet Mass Load (based on lab)" is an average daily rate of actual lab data collected. The report has been updated based on lab data received for samples collected through November 3, 2015.

Note that accumulated LNAPL is pumped through the NAPL conditioning system in a batch style process. The LNAPL daily mass removal rate has been calculated by calculating an average daily rate based on the total gallons processed each batch over the number of days between batches.

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6. Power Usage

The cumulative power usage is shown below. All electricity used at the site is utilized to run the process system and steam generators.

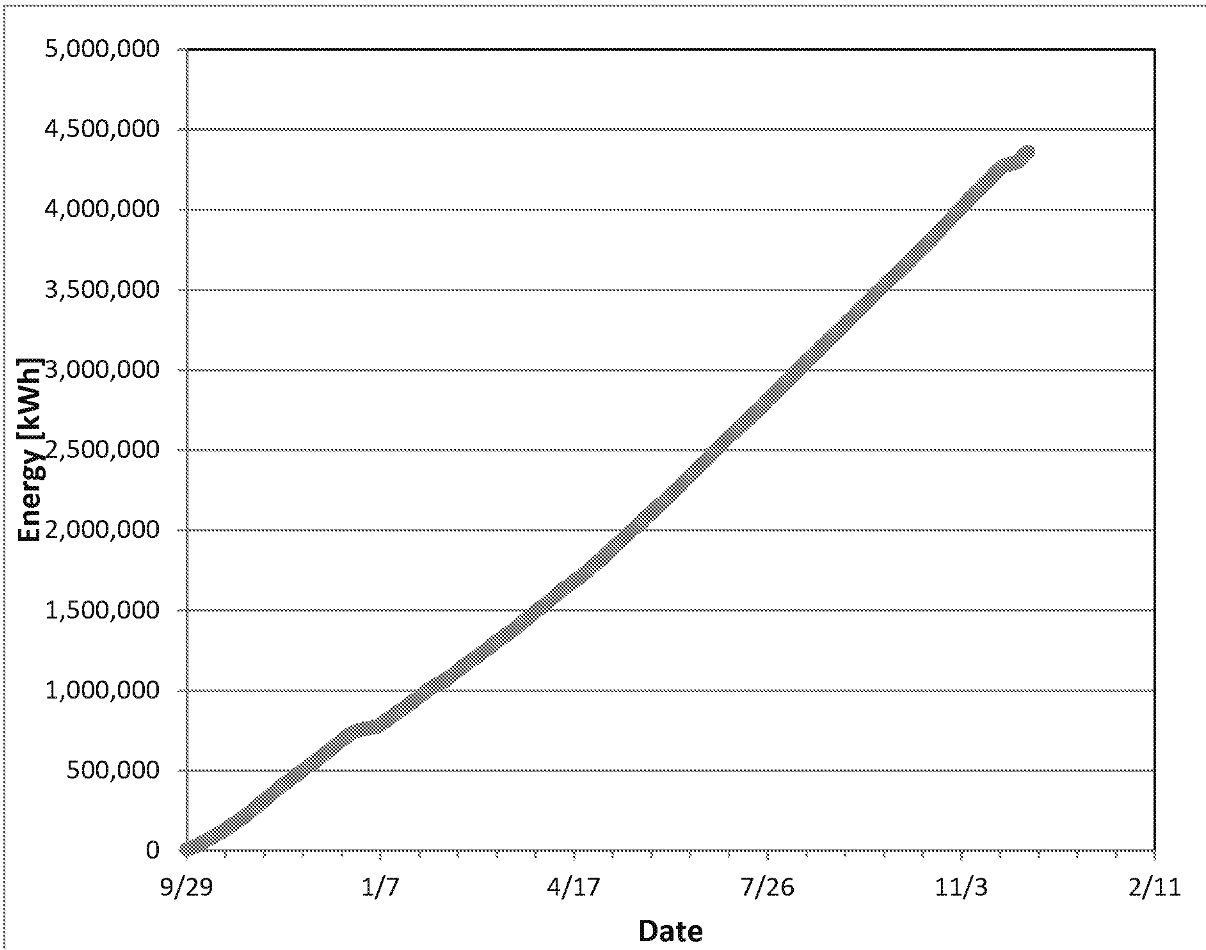

Figure 5. Cumulative Power Usage

7. Average Temperature

A detailed review of thermocouple sensor depths and temperatures over time was performed week ending November 13, 2015. Results of the review and updates are detailed in Table 2 below and shown in Figure 6 below.

Table 2. Temperature Monitoring Sensor History

Temperature Monitoring Point	Temperature Monitoring Sensor History
TMP01	Well compromised 6/9/2015, select sensors back online 7/15/2015. Well not extended down in the Lower Permeable Zone (LPZ) and LSZ.
TMP04	Well compromised 6/21/2015. Not included in LPZ and LSZ since 6/21/2015.
TMP05	Well compromised 5/6/2015, select sensors back online 7/15/2015. Sensors deeper than 160 ft have not been online since 5/6/2015 and therefore are not included in UWBZ, LPZ and LSZ.
TMP06	Well compromised 3/27/2015, select sensors back online 7/14/2015. On 9/10/2015 all sensors went offline and have been excluded from LPZ and LSZ averages.
TMP07	Well compromised 3/27/2015, select sensors back online 7/14/2015.
TMP08	Well partly compromised 9/11/2015 from 210 ft and down. The 215 and 235 ft sensors are still operating.
TMP09	Well compromised 2/9/2015 before CZ was turned on and UWBZ was up to temperature. The CZ and UWBZ temperatures have been excluded. LSZ temperatures have not been updated since 2/9/2015 (taken out of LSZ average).
TMP12	Sensors from 150 to 170 ft bgs only at ~50C. Brings down the average in CZ and UWBZ.
TMP13	Well compromised 3/27/2015, select sensors back online 4/30/2015. Since 7/1/2015 no sensor deeper than 225 ft has been operational.
TMP15	Well compromised 8/15/2015. 8/15/2015 temperatures assumed from this day.
TMP17	Well compromised 3/27/2015, select sensors back online 6/12/2015 but not reporting properly, total failure 7/16/2015. Depths lower than 235 not included in average since well was not at temperature when sensors failed. 7/16/2015 temperatures applied to average since well failed.

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The average soil temperatures as degrees Celsius (°C) and degrees Fahrenheit (°F) are shown in the figure below by treatment zone (i.e., LSZ, UWBZ and CZ).

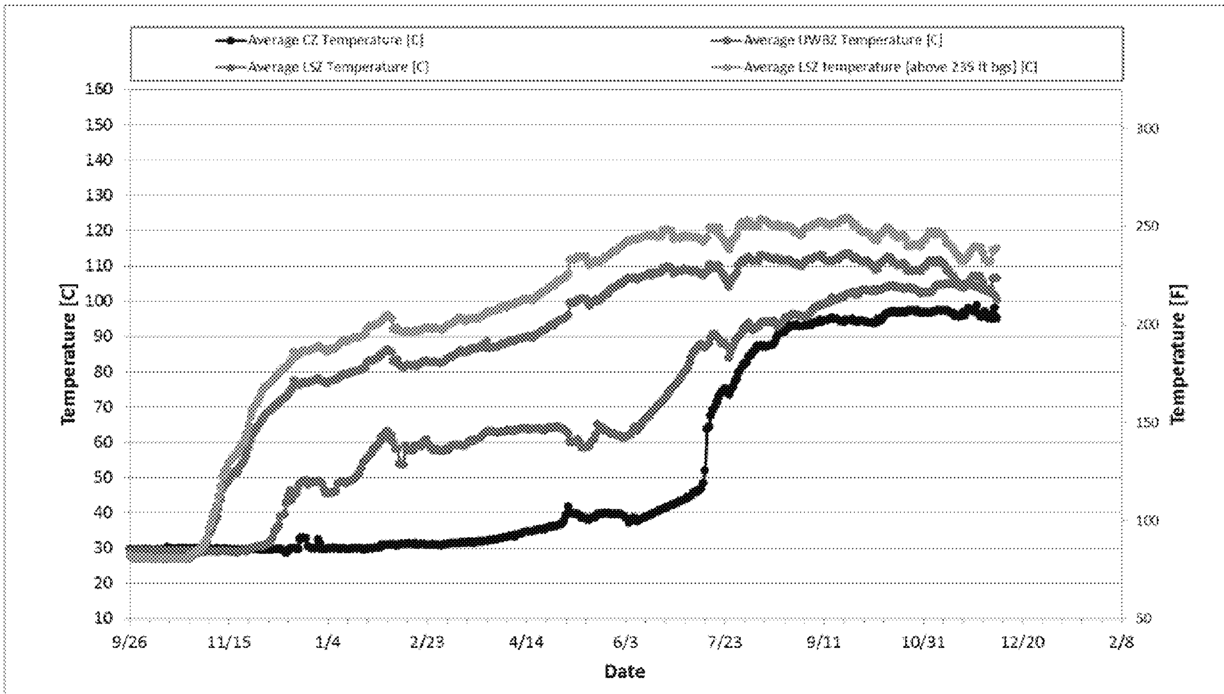

Figure 6. Average Soil Temperatures

Table 3 below provides a breakdown of the maximum average temperatures achieved at individual temperature monitoring points throughout SEE operations. The table below breaks down the average temperatures achieved across the CZ, UWBZ, Lower Permeability Zone (LPZ) and the LSZ. The LSZ is further broken down into the average for all LSZ sensors and those LSZ sensors above 235 ft bgs.

Table 3. Temperature Monitoring Point Maximum Depth-Averaged Temperature

	Temperature Monitoring Point Maximum Depth-Averaged Temperature[1] (°C) During SEE Operations by Zone				
Temperature Monitoring Point	**CZ**	**UWBZ**	**LPZ**	**LSZ**	**LSZ (depths above 235 ft bgs)**
TMP01	114.6	130.5	N/A	N/A	N/A
TMP03	N/A	N/A	137.5	114.2	120.7
TMP04	N/A	N/A	103.8	118.8	127.1
TMP05	110.3	N/A	N/A	N/A	N/A
TMP06	N/A	N/A	137.4	135.0	135.9
TMP07	N/A	N/A	134.6	137.2	140.2
TMP08	N/A	N/A	136.6	131.3	135.4
TMP09	N/A	N/A	132.5	134.1	139.3
TMP11	N/A	N/A	107.7	119.1	131.7
TMP12	75.7	90.3	121.8	121.4	131.3
TMP13	102.1	119.8	130.6	139.6	141.8
TMP14	N/A	N/A	133.6	124.3	136.3
TMP15	113.1	123.3	128.7	126.5	135.6
TMP16	N/A	N/A	126.7	120.4	131.0
TMP17	N/A	N/A	135.2	136.9	136.9
Maximum depth-averaged by zone[2]	**103.1**	**116.0**	**128.2**	**127.6**	**134.1**

If N/A, Temperature Monitoring Point has no sensors in that zone

[1] Temperature of the thermocouples across each depth zone are averaged for each TMP and each available time interval and then the maximum value of those averages throughout operations is listed in the table.

[2] Average of maximum depth-averages listed above for all TMPs in each zone.

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Table 3 below provides a breakdown of the maximum average temperatures achieved at individual temperature monitoring points throughout SEE operations. The table below breaks down the average temperatures achieved across the CZ, UWBZ, Lower Permeability Zone (LPZ) and the LSZ. The LSZ is further broken down into the average for all LSZ sensors and those LSZ sensors above 235 ft bgs.

Table 3. Temperature Monitoring Point Maximum Depth-Averaged Temperature

	Temperature Monitoring Point Maximum Depth-Averaged Temperature[1] (°C) During SEE Operations by Zone				
Temperature Monitoring Point	**CZ**	**UWBZ**	**LPZ**	**LSZ**	**LSZ (depths above 235 ft bgs)**
TMP01	114.6	130.5	N/A	N/A	N/A
TMP03	N/A	N/A	137.5	114.2	120.7
TMP04	N/A	N/A	103.8	118.8	127.1
TMP05	110.3	N/A	N/A	N/A	N/A
TMP06	N/A	N/A	137.4	135.0	135.9
TMP07	N/A	N/A	134.6	137.2	140.2
TMP08	N/A	N/A	136.6	131.3	135.4
TMP09	N/A	N/A	132.5	134.1	139.3
TMP11	N/A	N/A	107.7	119.1	131.7
TMP12	75.7	90.3	121.8	121.4	131.3
TMP13	102.1	119.8	130.6	137.3	138.5
TMP14	N/A	N/A	133.6	124.3	136.3
TMP15	113.1	123.3	128.7	126.5	135.6
TMP16	N/A	N/A	126.7	120.4	131.0
TMP17	N/A	N/A	135.2	136.9	136.9
Maximum depth-averaged by zone[2]	**103.1**	**116.0**	**128.2**	**127.4**	**133.8**

If N/A, Temperature Monitoring Point has no sensors in that zone

[1] Temperature of the thermocouples across each depth zone are averaged for each TMP and each available time interval and then the maximum value of those averages throughout operations is listed in the table.

[2] Average of maximum depth-averages listed above for all TMPs in each zone.

8. Vertical and Horizontal Temperature Profiles

The following Figures 7 and 8 show the temperature in °C versus depth profiles for each of the 17 individual temperature monitoring points. Please see Table 2 for an updated temperature monitoring sensor status.

TMP3 is currently providing suspect data and TerraTherm is currently observing the data reported from this location.

Temperature highlights for the past week include:

- TMP 01 has seen a drop in temperature from 170 ft bgs and below over the last week.
- Perimeter well TMP 02 has remained stable over the last week.
- TMP 05 has seen a decrease in temperature from the 150 ft bgs depth and below.
- TMP12 has dropped 1-5 °C in all three zones.
- Perimeter well TMP 10 has dropped a couple of degrees at each depth from 180 ft bgs and down.

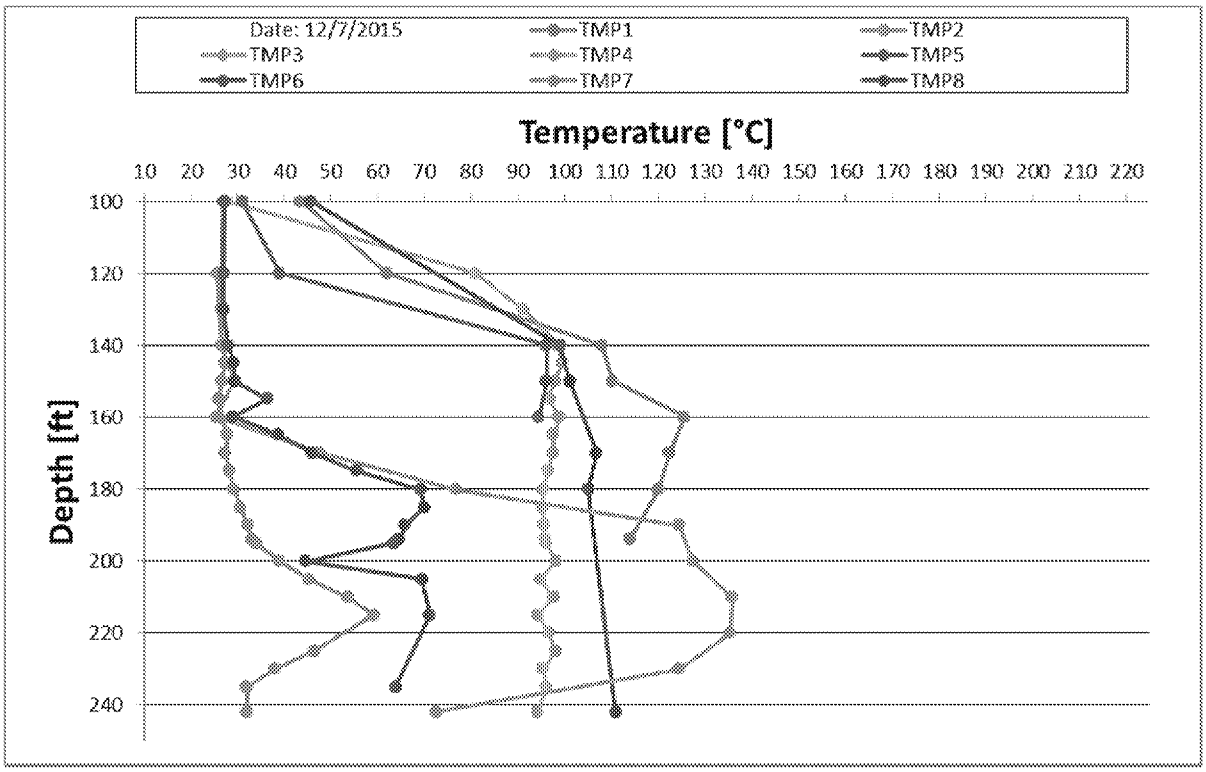

Figure 7. Vertical Temperature Profiles (TMP01 through TMP08)

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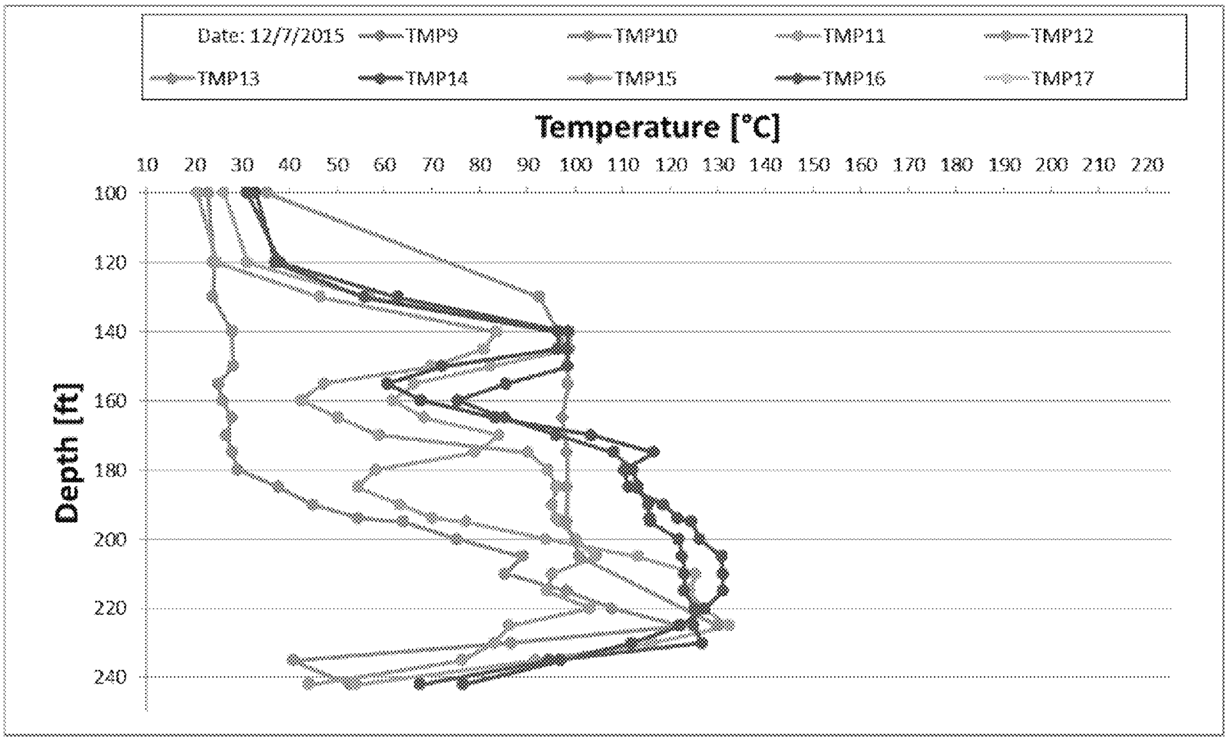

Figure 8. Vertical Temperature Profiles (TMP09 through TMP17)

Figures 9-12 show the horizontal temperature distribution across the site in four depth intervals.

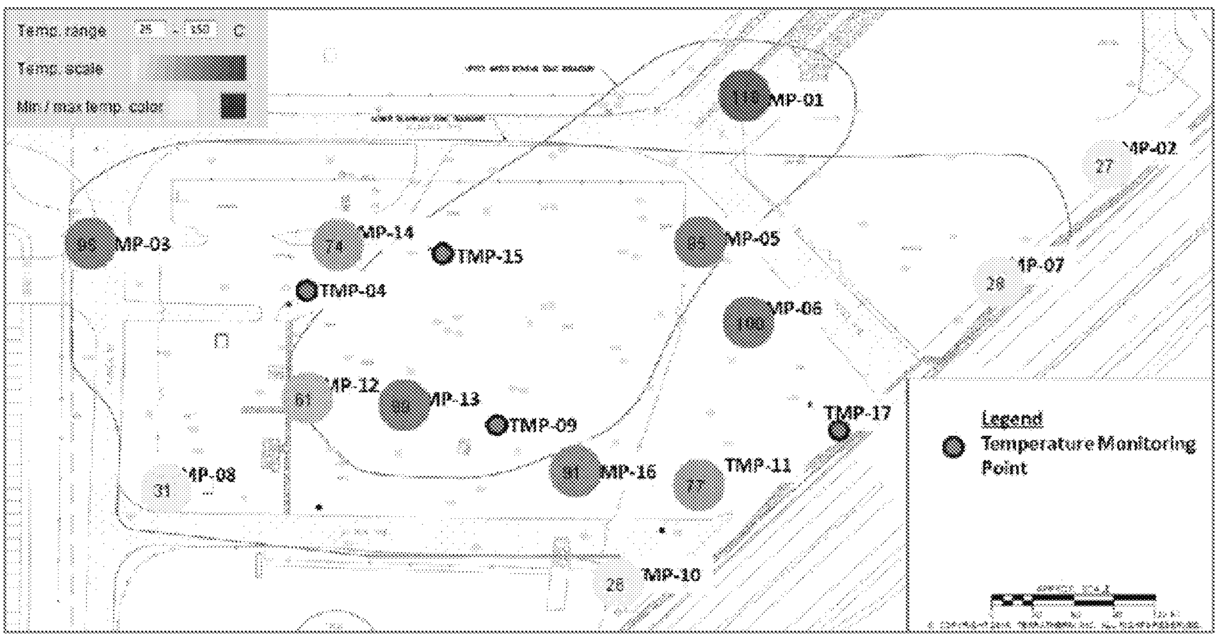

Figure 9. Horizontal Temperature Distribution across the CZ (145-160 ft bgs) (temperatures shown in °C)

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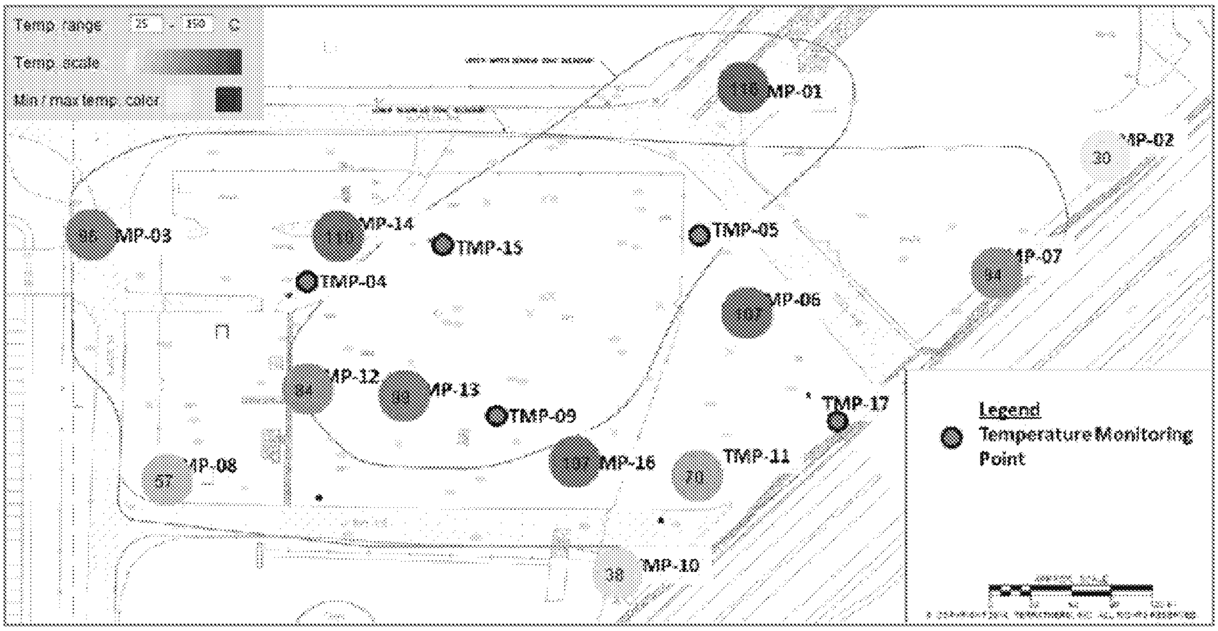

Figure 10. Horizontal Temperature Distribution across the UWBZ (161-195 ft bgs) (temperatures shown in °C)

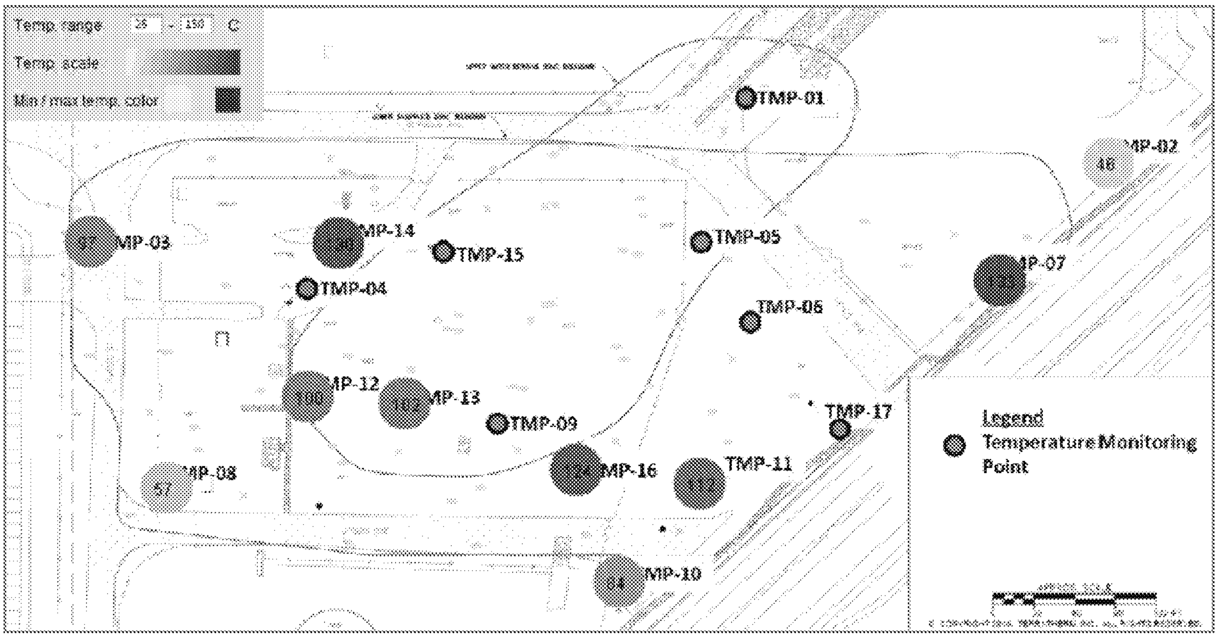

Figure 11. Horizontal Temperature Distribution across the Lower Permeable Zone (196-210 ft bgs) (temperatures shown in °C)

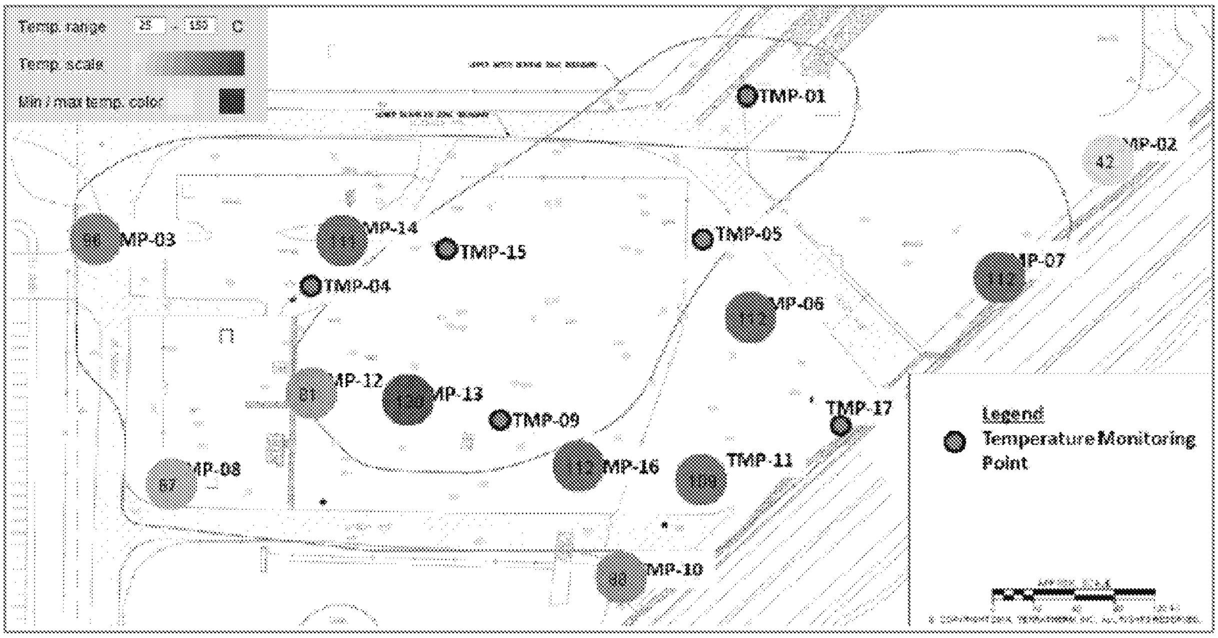

Figure 12. Horizontal Temperature Distribution across the LSZ (211-245 ft bgs) (temperatures shown in °C)

Figure 13 below shows the observed temperatures by depth at selected LSZ extraction wells.

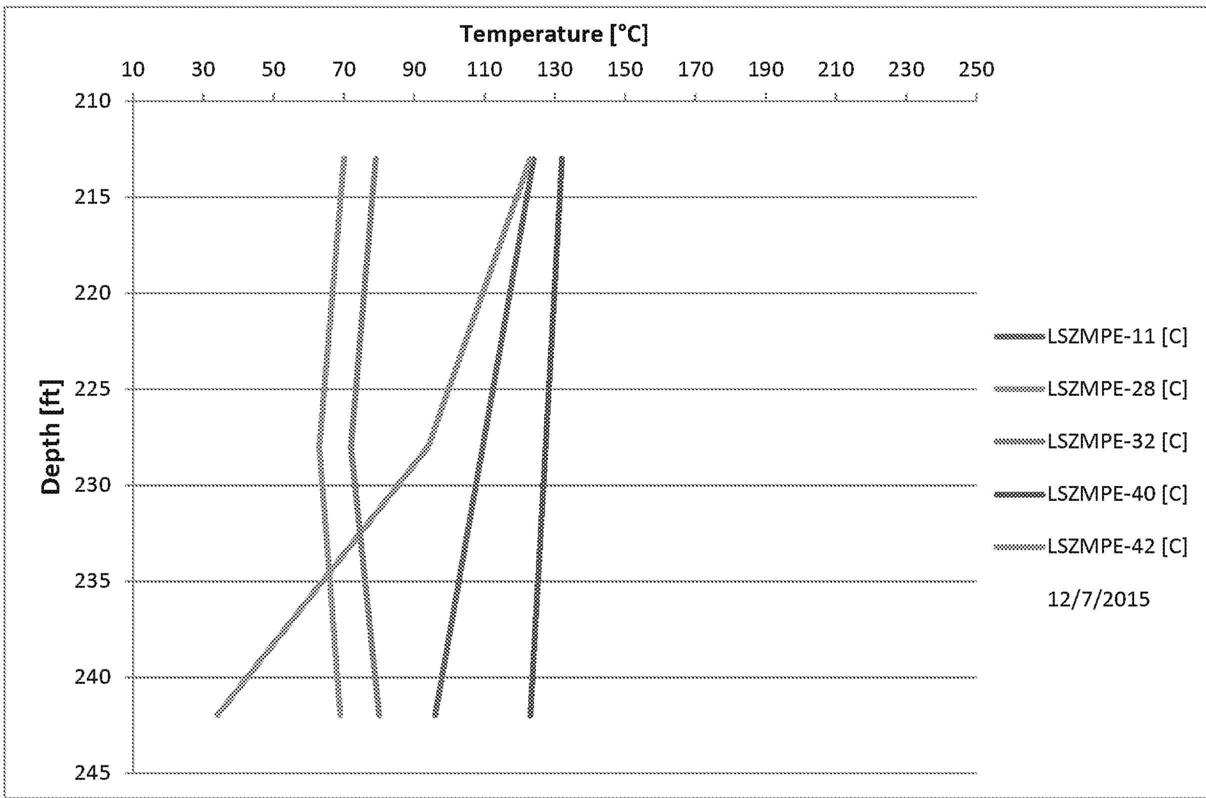

Figure 13. Temperatures by Depth at Selected LSZ Extraction Wells (211-245 ft bgs) (temperatures shown in °C)

9. Cumulative Steam Injection

Steam injection was initiated Thursday, October 16, 2014. Figure 14 below shows the cumulative steam injection for each of the three injection zones.

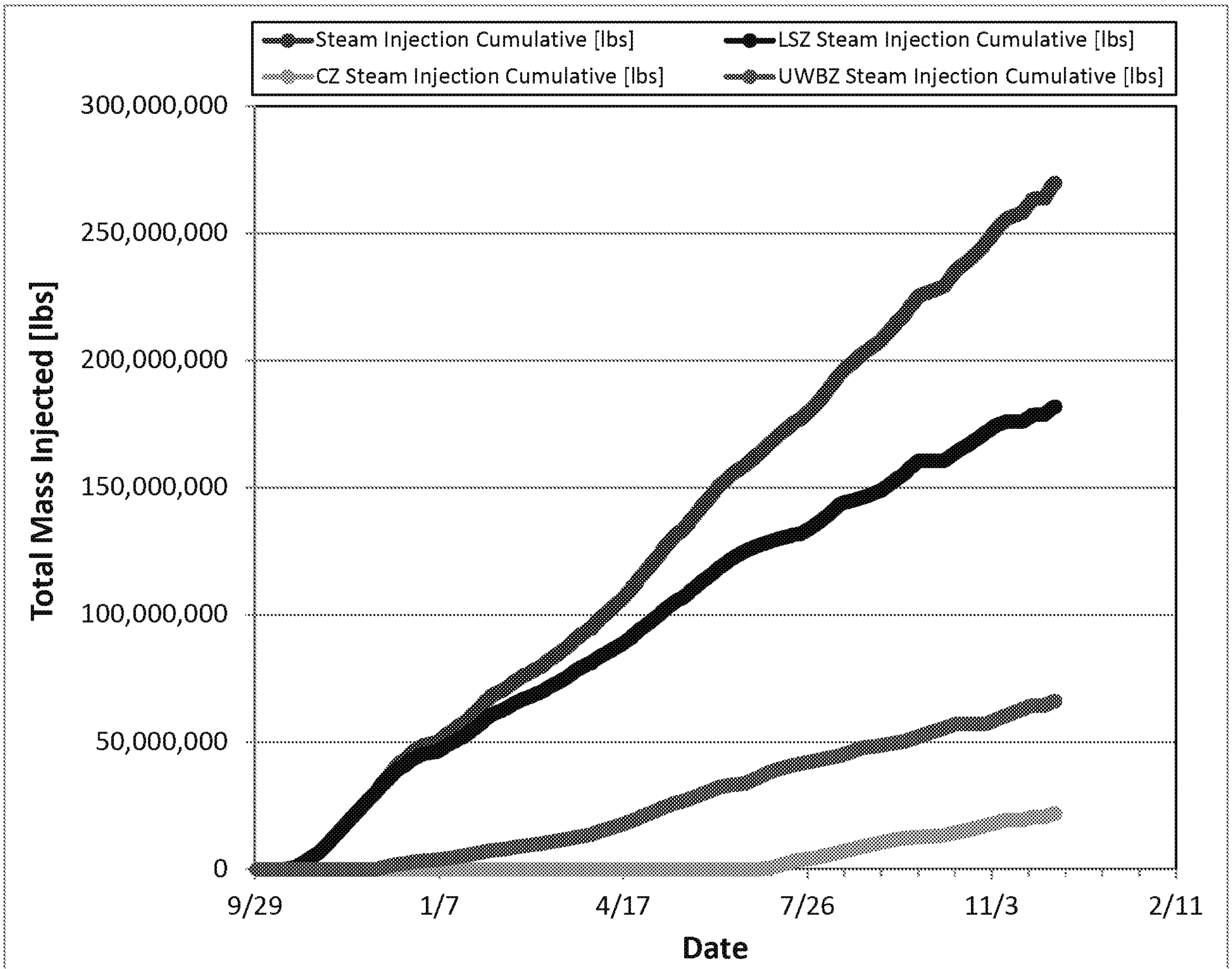

Figure 14. Cumulative Steam Injection for Each of the Three Injection Zones

10. Steam Injection Rates

The figure below shows the steam injection rates for each of the three injection zones.

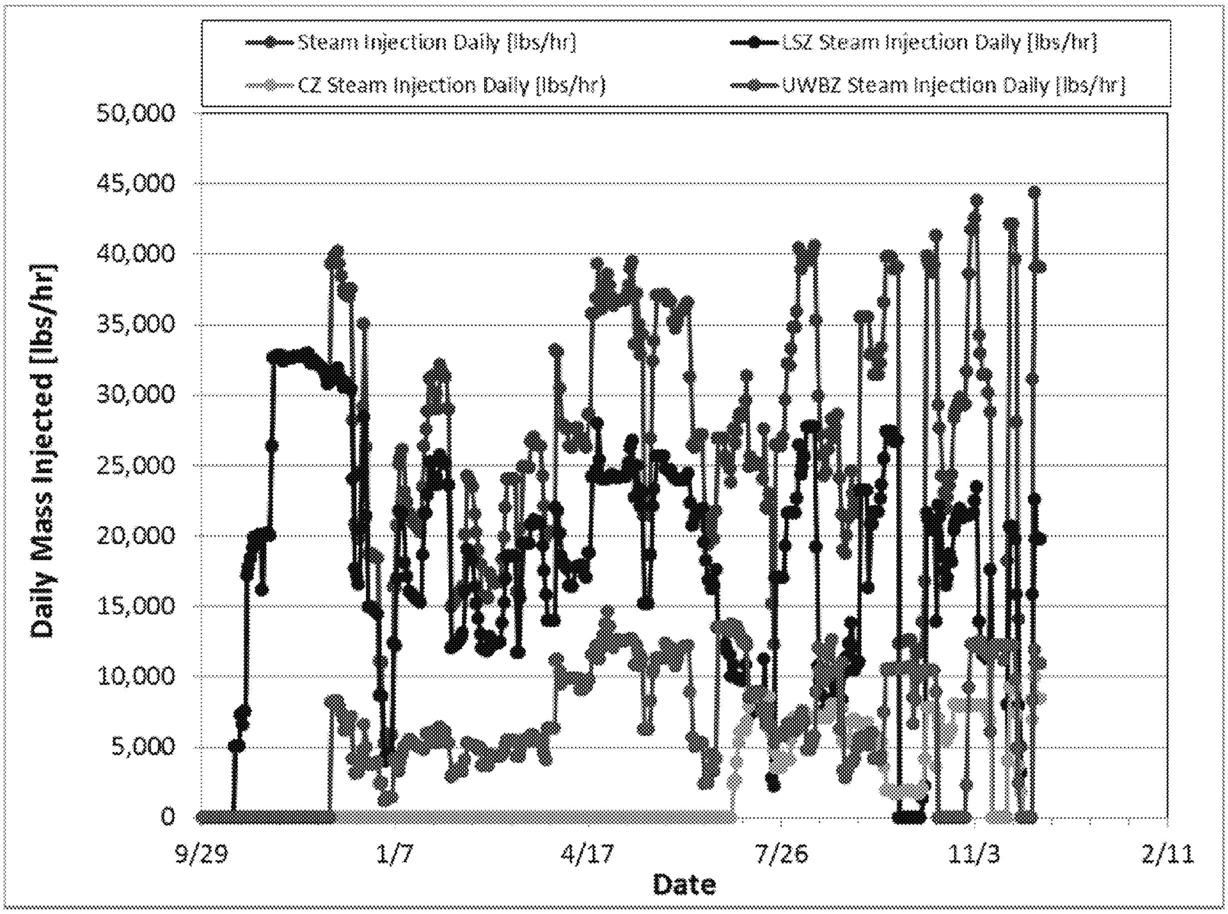

Figure 15. Steam Injection Rate for Each of the Three Injection Zones

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11. Cumulative Water Extraction by Zone

The cumulative water extraction for each of the three treatment zones is shown below. The cumulative water extraction is calculated based on flow meters installed at each of the 57 extraction wells (accuracy should be considered +/- 20%). The figure below shows the net liquid extracted from the subsurface at the site and does not include the fraction of water that is recirculated to the eductor wells and used as motive water.

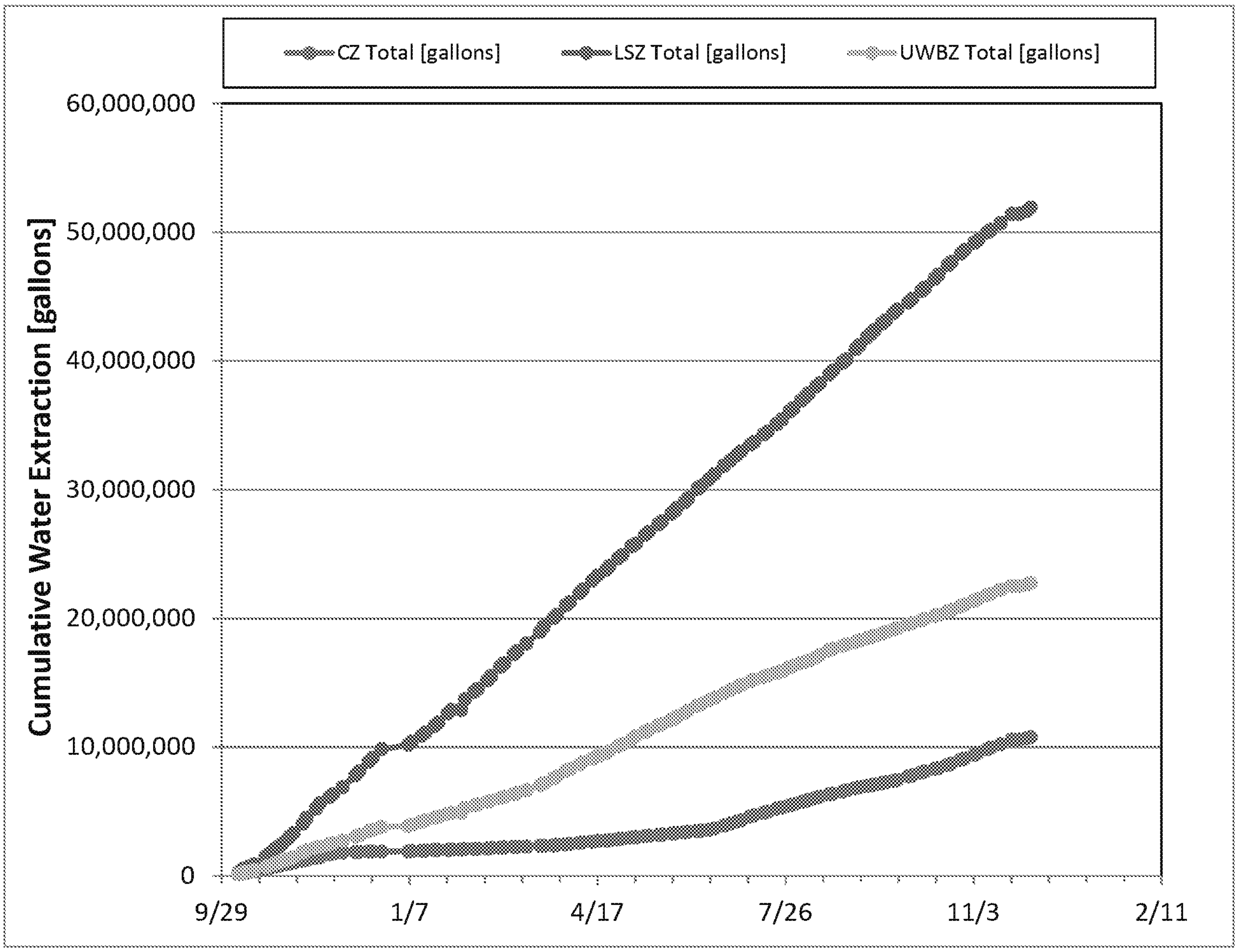

Figure 16. Cumulative Water Extraction for Each of the Three Treatment Zones

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12. Water Extraction Rates by Zone

The figure below shows the water extraction rates for each of the three treatment zones.

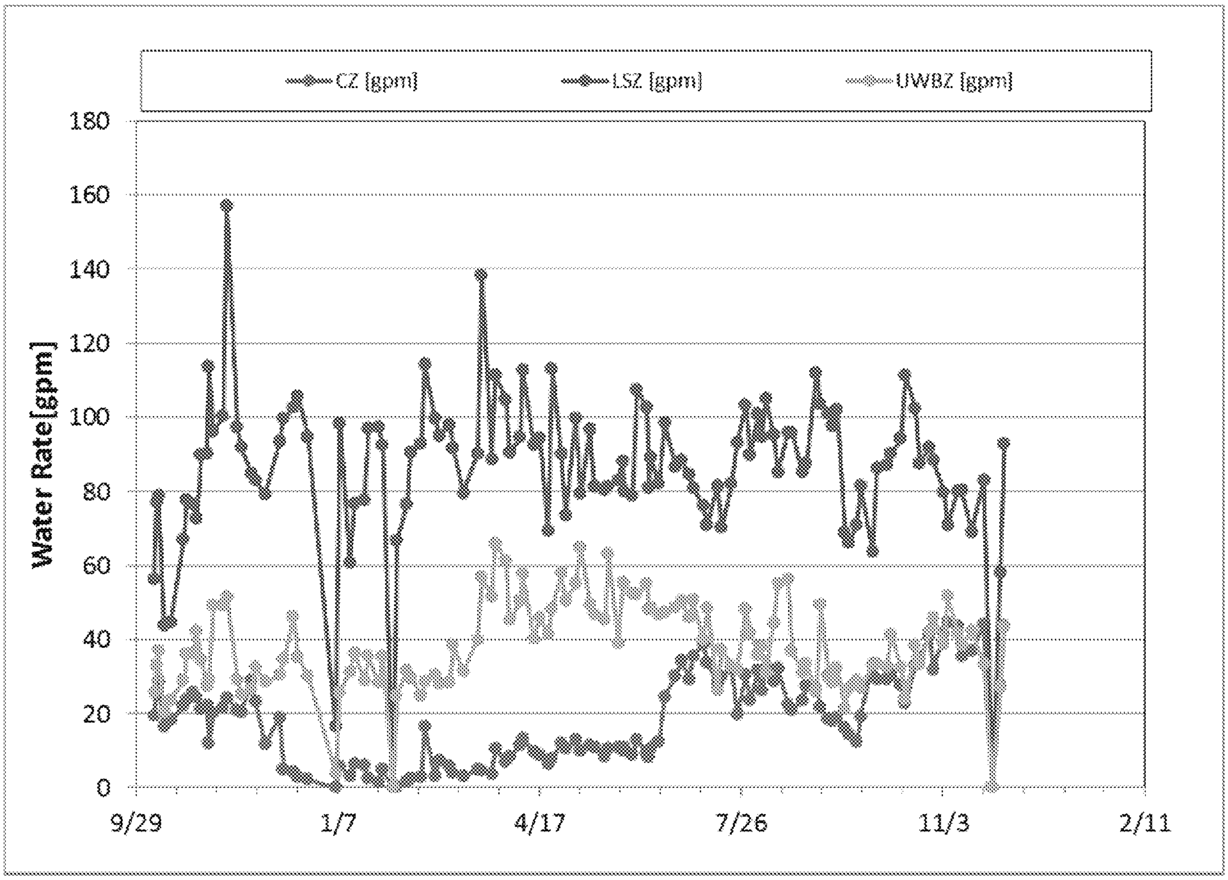

Figure 17. Water Extraction Rates for Each of the Three Treatment Zones

13. Cumulative Water Balance

The cumulative water balance for the site is shown below. The chart shows the net liquid extracted from the subsurface at the site and does not include the fraction of water that is recirculated to the eductor wells and used as motive water.

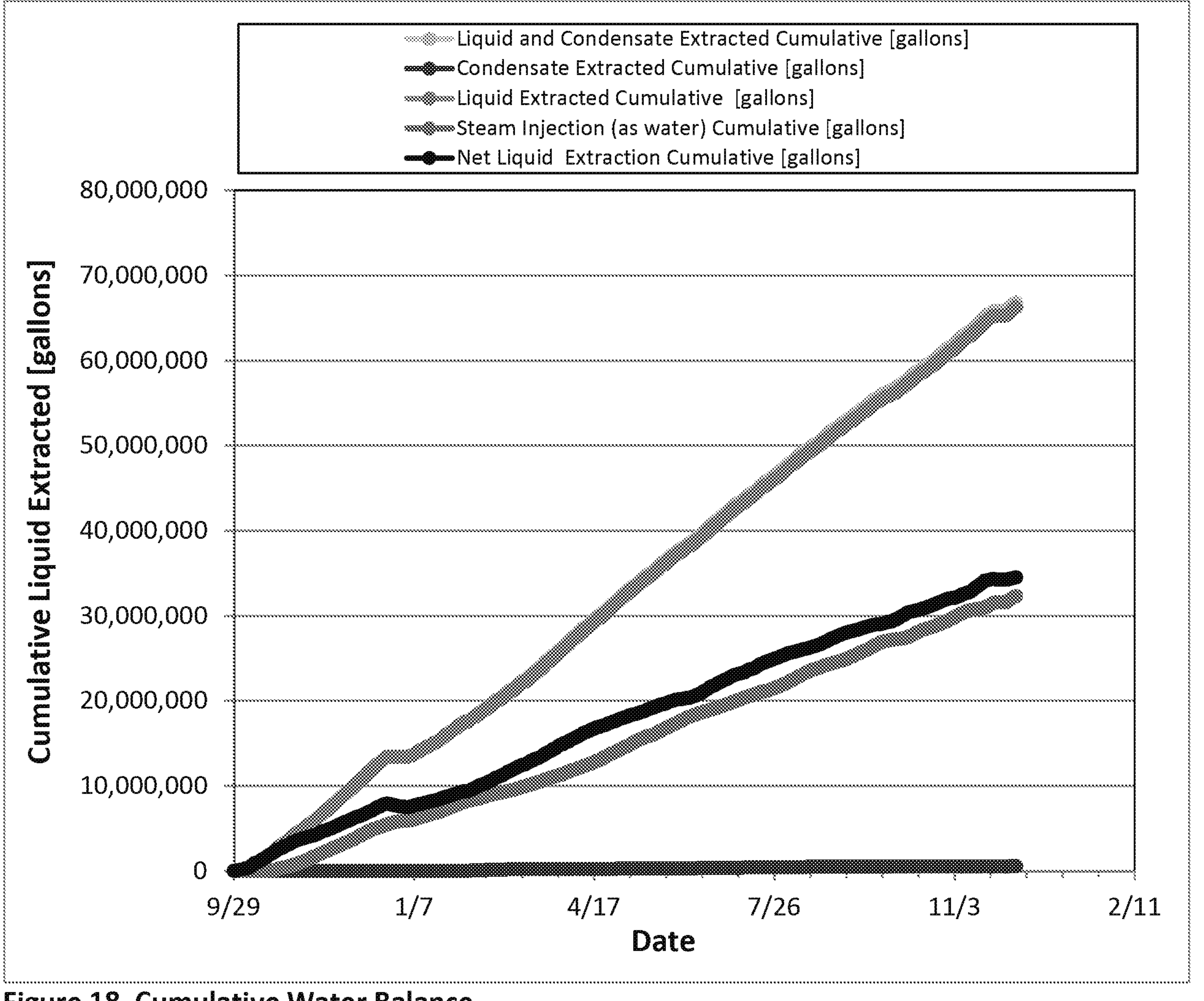

Figure 18. Cumulative Water Balance

14. Water Balance Rate

The total system water extraction rates are shown in the figure below.

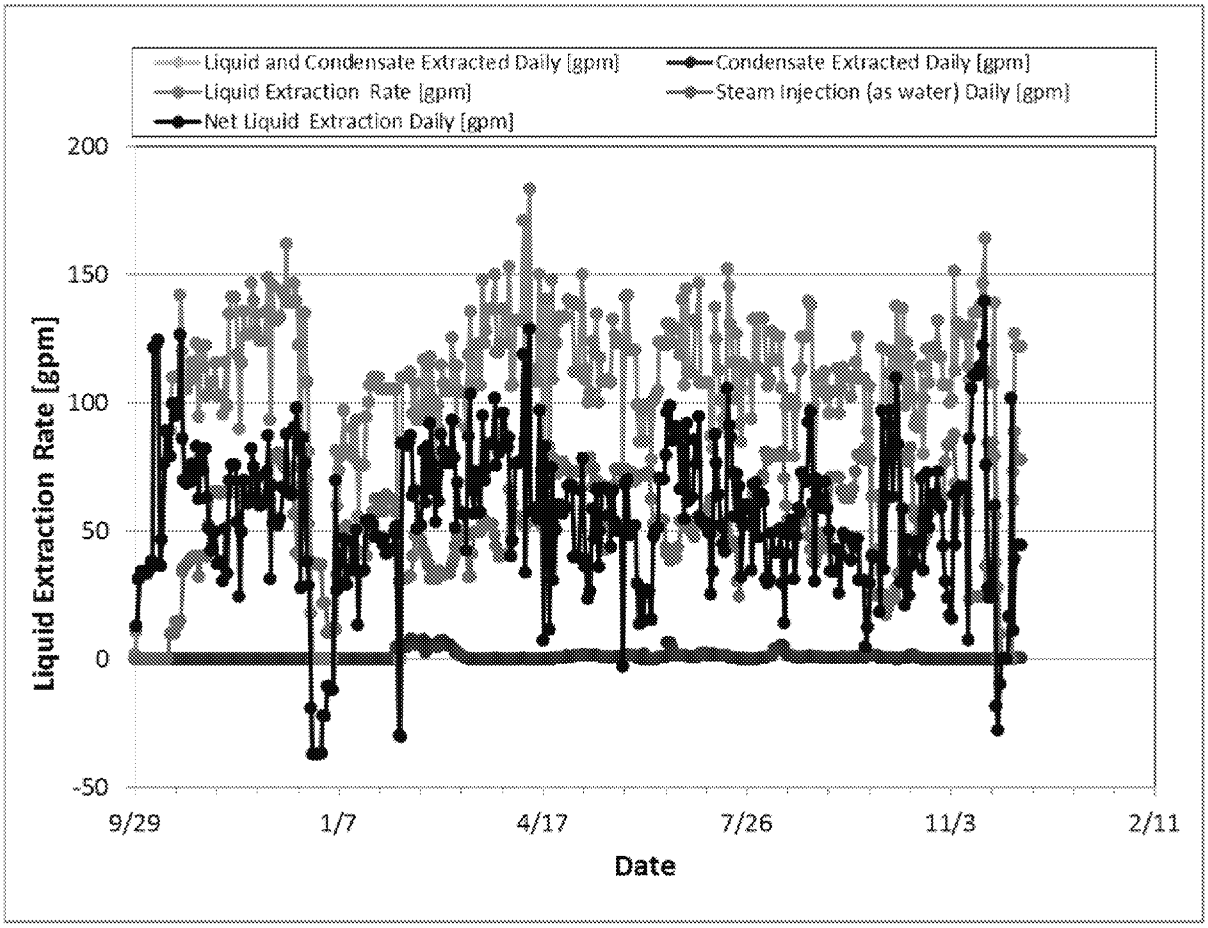

Figure 19. Water Balance Rates

15. Cumulative Energy Balance

The cumulative energy balance for the site is shown below. The energy balance has been updated to include calculated heat losses that are a combination of heat lost below the TTZ, above the TTZ and outside the TTZ. The heat losses were calculated according to the following approach:

- Based on the original SEE model, cumulative modeled heat losses were calculated for each operational phase (i.e., heat up, pressure cycling);
- The heat losses were compared to the cumulative energy added as steam for each operational phase;
- The percent of total steam energy "lost" was calculated by comparing modeled heat losses to modeled steam injection;
- Since the actual steam injection rates at ST012 have been different than originally modeled, the percent heat loss calculated for each operational phase in the model was applied to the actual steam injected to get the calculated heat losses during operation; and,
- The calculated heat losses were subtracted from the net energy injection to calculate the net energy injected with heat losses.

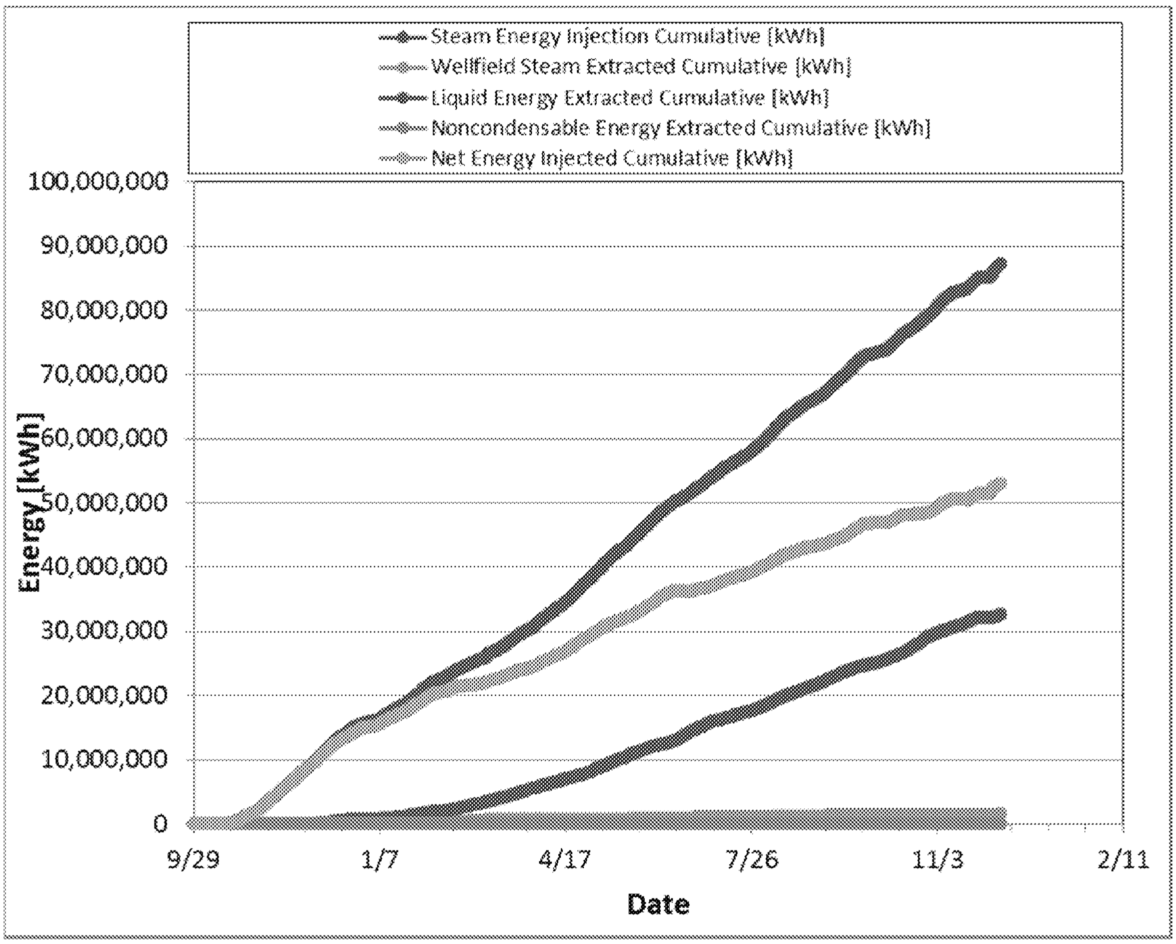

Figure 20. Cumulative Energy Balance

16. Energy Balance Rates

The energy balance rates are shown below.

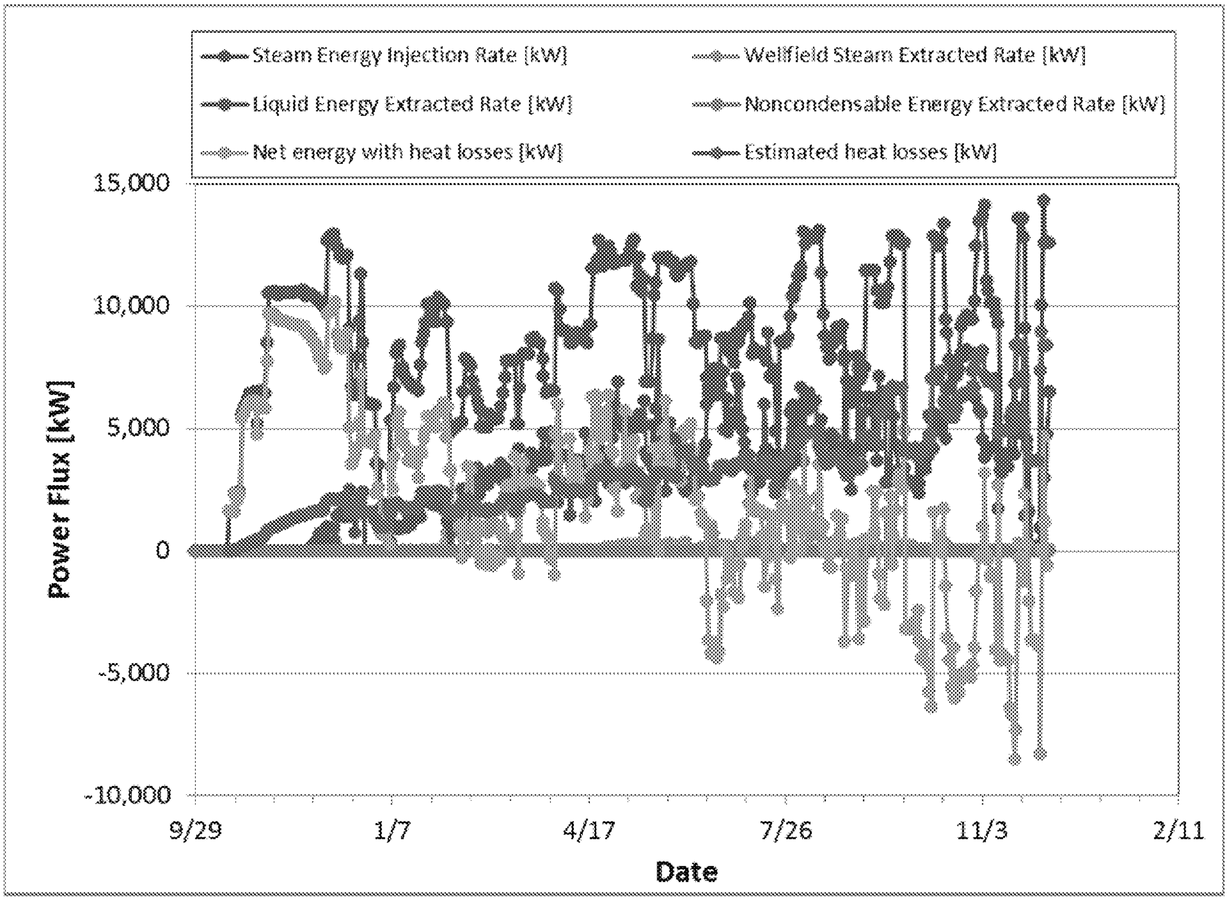

Figure 21. Energy Balance Rates

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17. Perimeter Water Level Data

Table 4 below presents the change in perimeter groundwater elevations since SEE system startup. The readings collected on September 24, 2014 (not shown) represent baseline conditions. A negative number shows that the groundwater elevation is lower than the baseline elevation, thus indicating an inward hydraulic gradient into the treatment zone. Liquid extraction began on September 29, 2014. Perimeter water level data are collected on a weekly basis. The regional groundwater table at the Site is increasing at a rate of approximately 1.5 ft/year; thus, each measured value shown in Table 4 has been corrected to take the regional changes into account.

Table 4. Perimeter Groundwater Elevation Changes

	11/13/2015		11/20/2015		11/27/2015		12/4/2015	
Monitoring Well	Change from Baseline	Change from Previous	Change from Baseline	Change from Previous	Change from Baseline	Change from Previous	Change from Baseline	Change from Previous
CZ/UWBZ Wells								
ST012-C01	-0.90	0.10	-1.06	-0.13	-1.08	0.01	-1.22	-0.11
ST012-C02	-0.67	0.18	-1.01	-0.32	-0.60	0.44	-1.03	-0.40
UWBZ Wells								
ST012-RB-3A	-0.26	0.10	-0.88	-0.60	-1.15	-0.24	-2.59	-1.41
ST012-U02	-0.30	0.17	-0.71	-0.39	-0.82	-0.08	-1.71	-0.86
ST012-U11	-0.67	-0.28	-1.40	-0.71	-1.28	0.15	-2.37	-1.06
ST012-U12	-0.63	-0.49	-1.75	-1.10	-2.12	-0.34	-3.75	-1.60
ST012-U37	-0.14	-0.14	-0.88	-0.72	-1.37	-0.46	-2.59	-1.19
ST012-U38	-0.43	0.40	-0.79	-0.34	-0.80	0.02	-1.48	-0.65
LSZ Wells								
ST012-W11	-5.53	-1.52	-6.94	-1.38	-4.03	2.94	-3.41	0.64
ST012-W12	-4.73	-2.16	-6.30	-1.55	-3.25	3.08	-3.12	0.16
ST012-W24	-1.83	-0.54	-4.32	-2.47	-5.59	-1.24	-2.91	2.71
ST012-W30	-4.20	-1.98	-6.14	-1.91	-2.97	3.20	-3.35	-0.36
ST012-W34	-3.67	-2.33	-5.08	-1.39	-2.46	2.65	-2.17	0.32
ST012-W36	-0.72	-0.70	-3.81	-3.07	-5.56	-1.72	-2.16	3.43
ST012-W37	2.79	4.52	-5.55	-8.31	0.80	6.38	-4.11	-4.89
ST012-W38	-3.14	-1.94	-4.51	-1.35	-2.07	2.47	-2.14	-0.04

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Figure 22 shows the manually collected groundwater elevation trends since system startup. Additionally Figure 23 shows the groundwater elevations continuously logged in selected perimeter wells equipped with transducers. The regional groundwater table correction has also been applied to Figure 22 below.

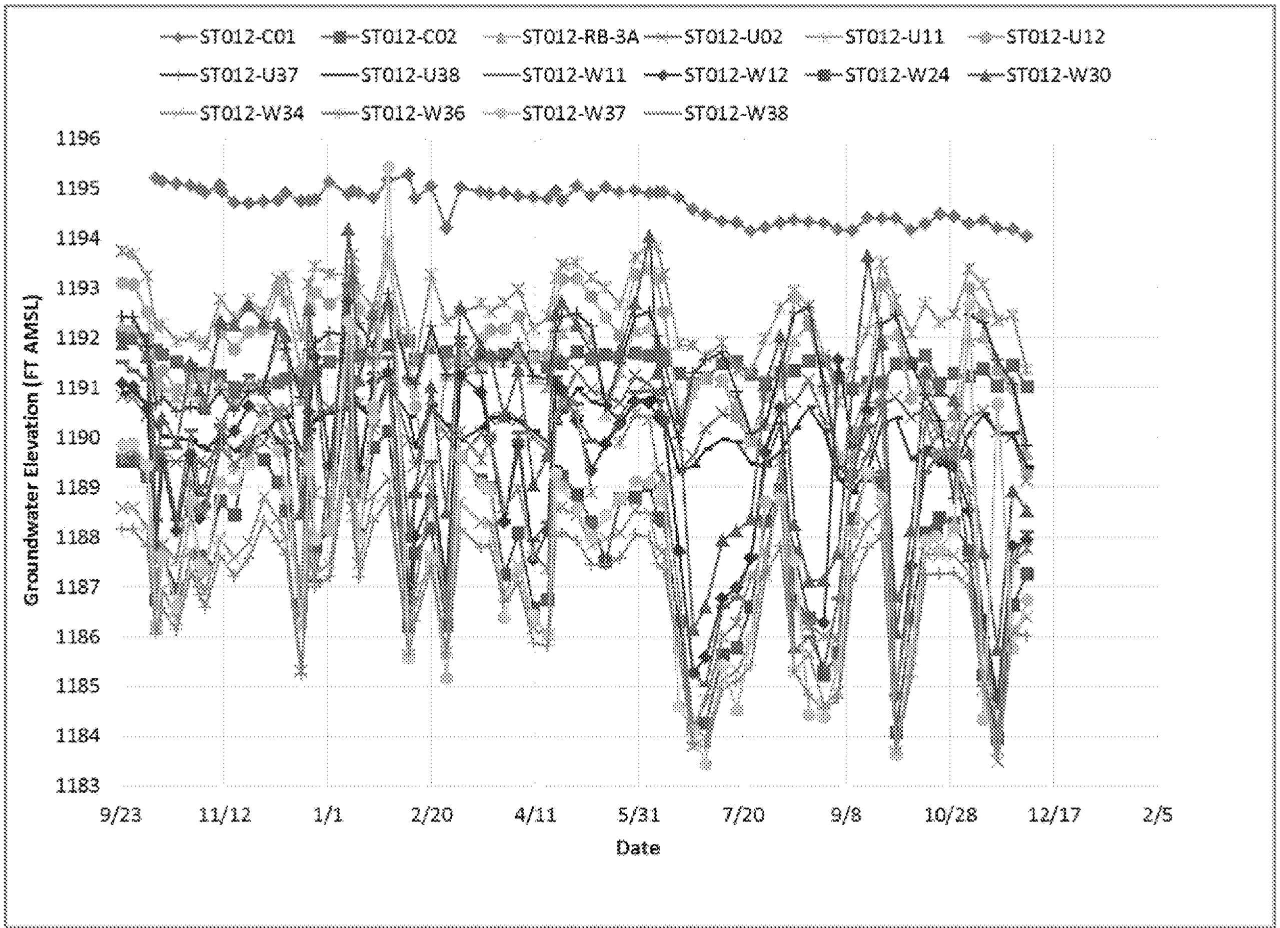

Figure 22. Manually Collected Perimeter Groundwater Elevations

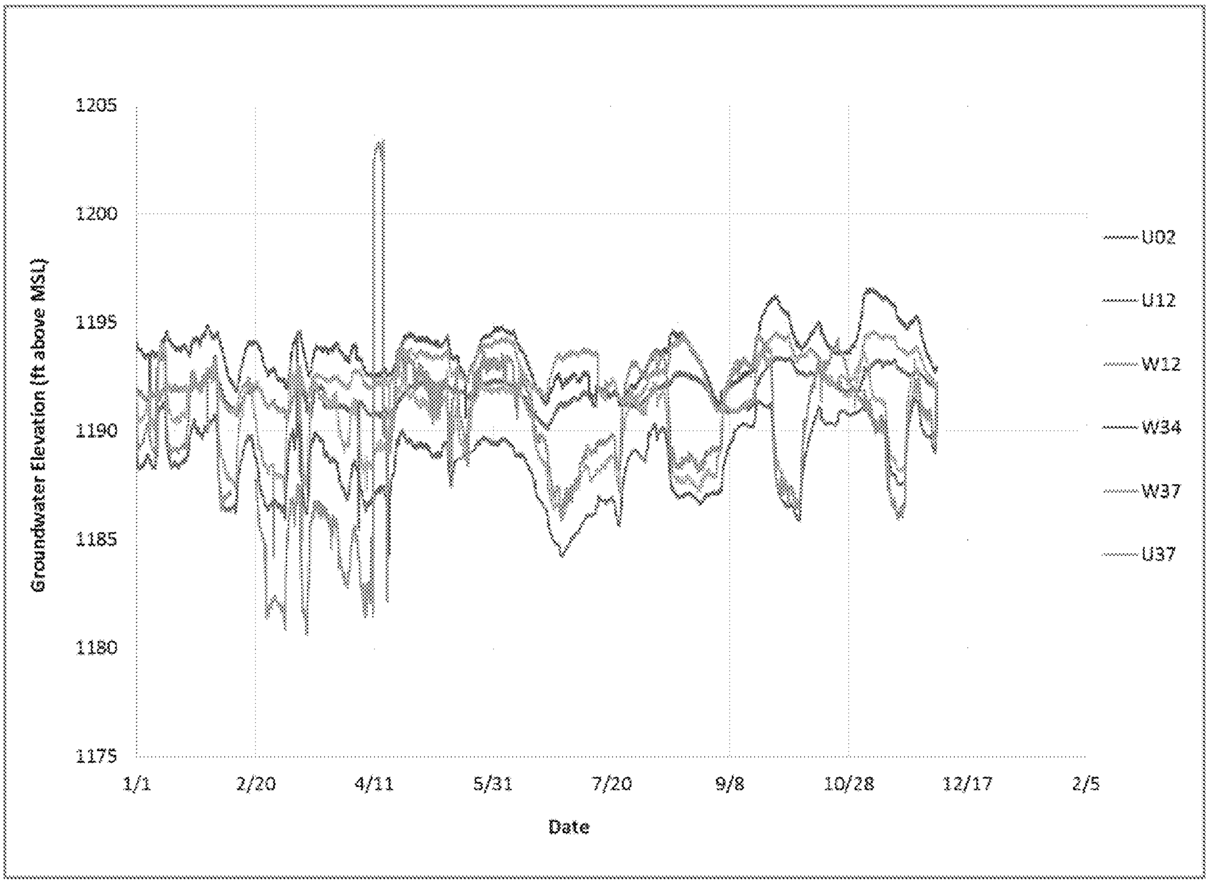

Figure 23. Automatically Collected Perimeter Groundwater Elevations

Table 5 below presents the measured LNAPL thicknesses of the perimeter wells at the site. Perimeter LNAPL thickness data are collected on a weekly basis.

Table 5. Perimeter LNAPL Thicknesses (ft)

Monitoring Well	11/13/2015		11/14/2015		11/27/2015		12/4/2015	
CZ/UWBZ Wells	Before bailing	After Bailing	Before bailing	After Bailing	Before bailing	After Bailing	Before bailing	After Bailing
ST012-C01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST012-C02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UWBZ Wells								
ST012-U02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST012-U11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST012-U12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST012-U37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST012-U38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST012-RB-3A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LSZ Wells								
ST012-W11	21.63	14.49	23.33	20.19	2.77	2.77	4.50	4.50
ST012-W12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST012-W24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST012-W30	0.00	0.00	0.03	0.03	0.03	0.03	0.02	0.02
ST012-W34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST012-W36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST012-W37	82.36	17.94	3.15	0.22	13.59	13.59	19.90	19.90
ST012-W38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

On December 1, 2014, temperatures at selected perimeter wells were added to the monitoring program. Figure 24 below shows the manually collected temperatures recorded at the wells included in the monitoring program. Additionally Figure 25 shows the temperatures continuously logged in selected perimeter wells equipped with transducers.

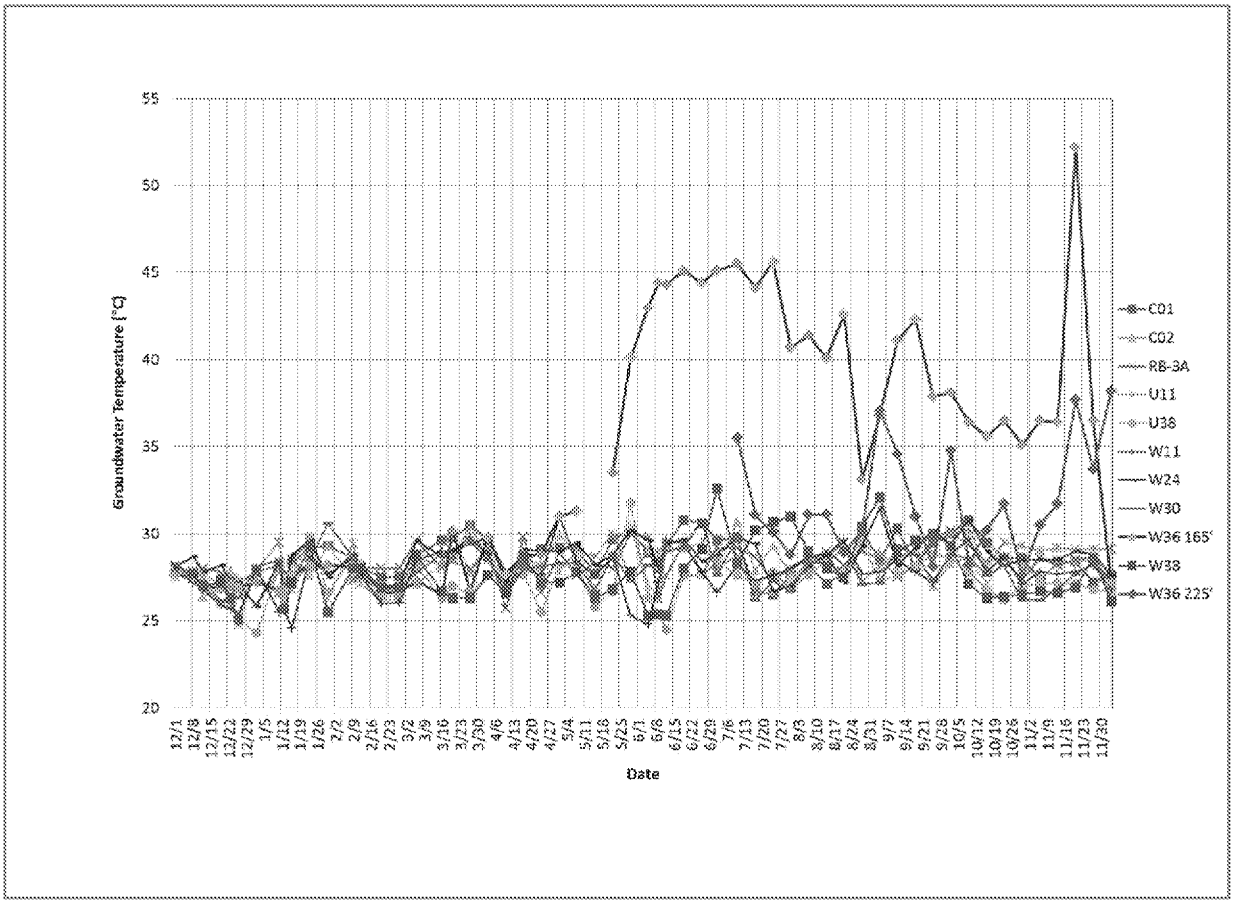

Figure 24. Manually Collected Perimeter Well Groundwater Temperatures

Note: Thermocouples are measured at approximate depths as follows (in feet below top of casing): C01=162; C02=168; RB-3A=161; U11=180; U38=164; W11=228; W24=230; W30=231; W36=225; and W38=228.

As a response to the increased temperatures observed at W36 on November 20,2015 steam at nearby UWBZ9 and UWBZ25 were decreased.

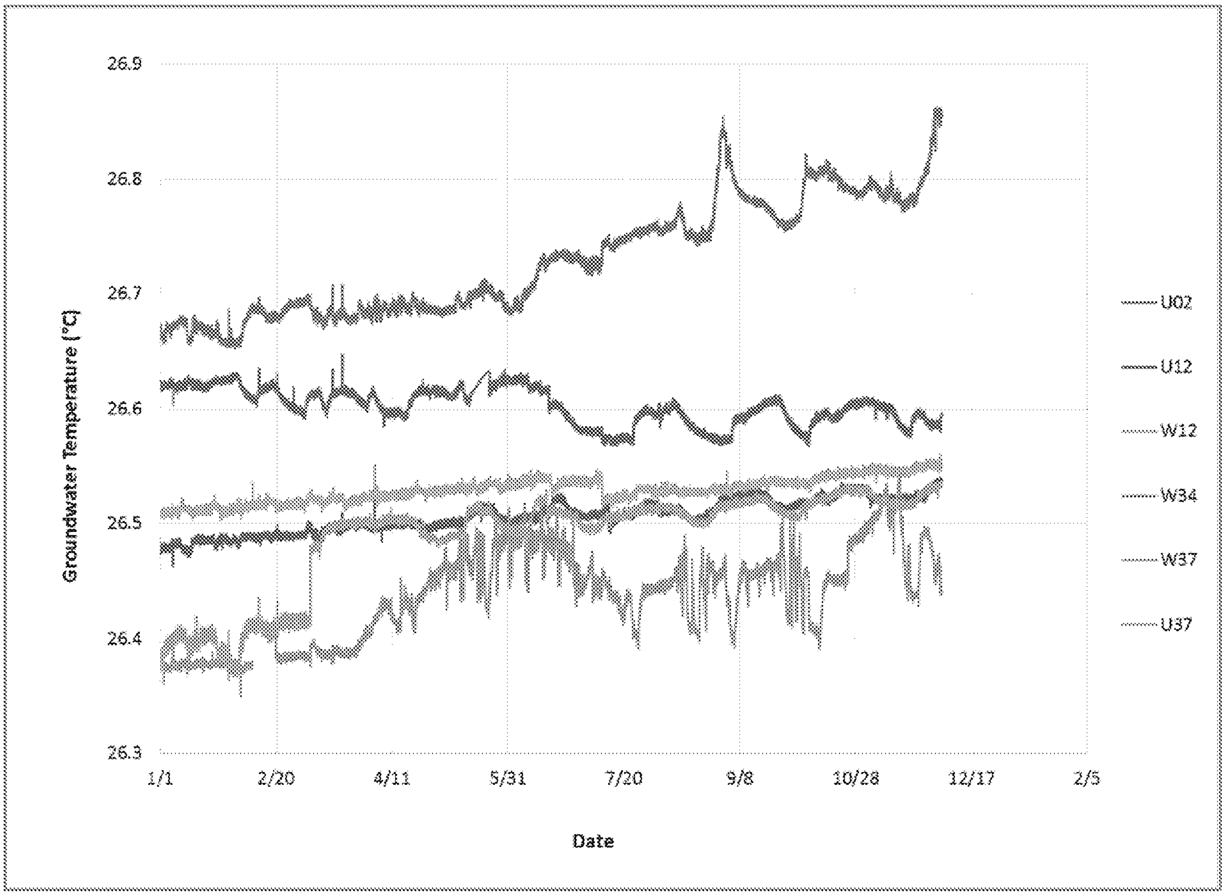

Figure 25. Automatically Collected Perimeter Well Groundwater Temperatures

Notes:
On March 7, 2015 operational personnel replaced the U37 logger unit. The increase in temperature on March 7, 2015 at U37 is a result of this replacement.

Transducers are measured at depths as follows (in feet below top of casing): U02= 175; U12= 175; U37= 182; W12= 228; W34= 225; and W37= 226.

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18. Natural Gas Usage

The following figure shows the natural gas usage rate in cubic feet per hour (cf/hr) and cumulative natural gas use in cubic feet (cf) to date at the site.

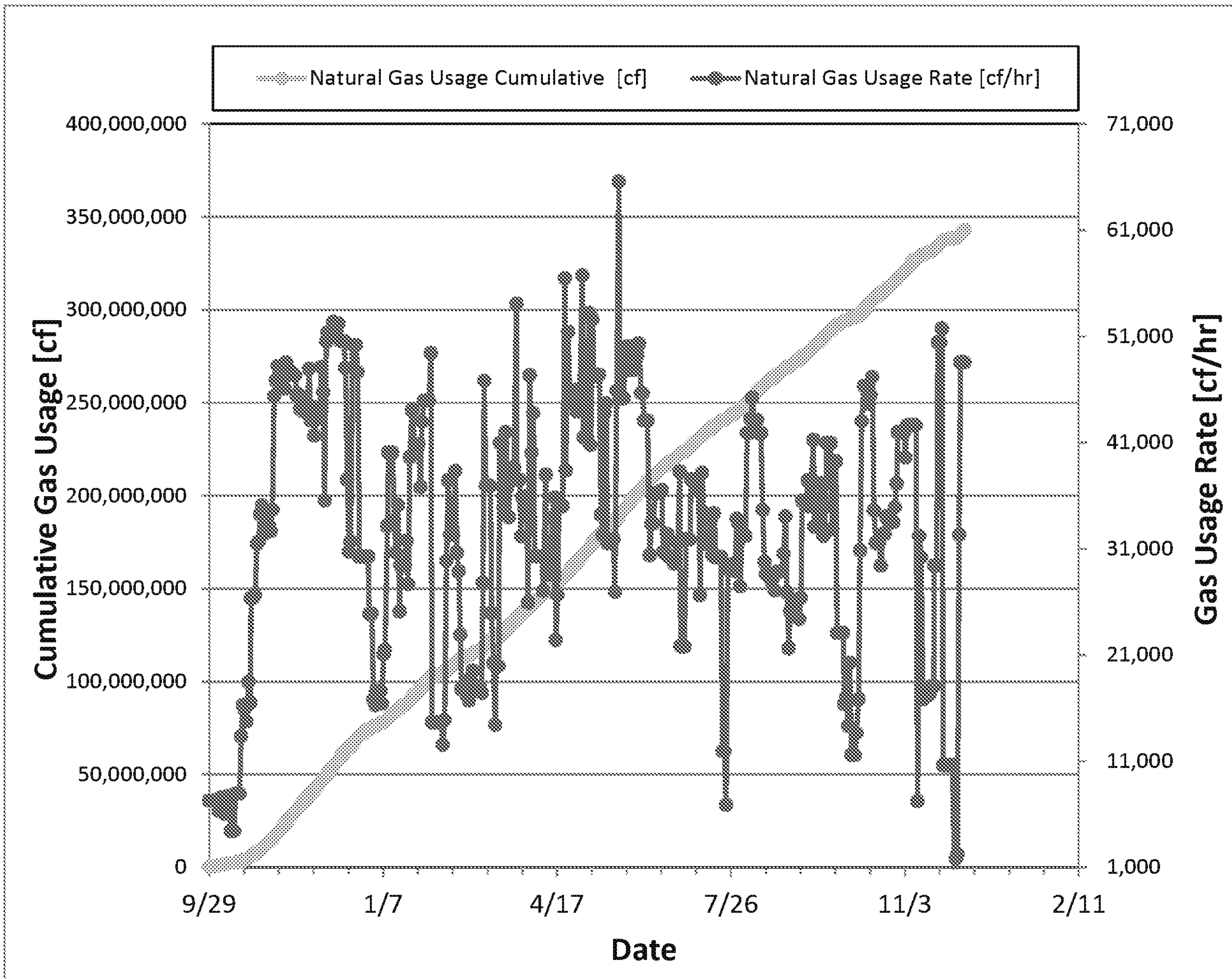

Figure 26. Natural Gas Usage

19. Waste Generation

On January 19, 2015 a total of 8,033 gallons of material from tank cleanout activities was removed from the site by Mesa Oil for recycling. The mass of JP-4 in the material was estimated to be 2,857 gallons or 18,800 lbs.

On February 18 and 19, 2015 a total of 24,430 gallons of material from tank cleanout activities was removed from the site by Mesa Oil for recycling. The mass of JP-4 in the material was estimated to be 3,645 gallons or 23,984 lbs.

On March 12, 2015 a total of 11,359 gallons of predominantly water from tank cleanout activities was removed from the site by Mesa Oil for recycling. The JP-4 mass in the water was limited.

On March 20, 2015 the first shipment of bag filters (four cubic yard boxes) from the SEE process treatment system was shipped offsite for non-hazardous disposal.

On March 30 and 31, 2015 a total of 32,000 lbs of spent liquid carbon was removed from the site by Evoqua Water Technologies for regeneration at their Red Bluff, CA facility.

On April 24, 2015 a shipment of bag filters (three cubic yard boxes) from the SEE process treatment system was shipped offsite for non-hazardous disposal.

On May 29, 2015 a shipment of bag filters (four cubic yard boxes) from the SEE process treatment system was shipped offsite for non-hazardous disposal.

On June 11, 2015 three 55-gallon drums of soil dug from around the Hypro NAPL filter were shipped offsite for non-hazardous disposal.

On June 10, 2015 a total of 5,727 gallons of oily bio-impacted water from tank cleanout activities was removed from the site by Mesa Oil for recycling.

On June 25, 2015 a shipment of bag filters (four cubic yard boxes) from the SEE process treatment system was shipped offsite for non-hazardous disposal.

On August 19, 2015 a total of 16,000 lbs of spent liquid carbon was removed from the site by Evoqua Water Technologies for regeneration at their Red Bluff, CA facility.

On August 27, 2015 a total of five totes with approximately 250 gallons each of water/solids from disinfection of the liquid carbon vessel were removed from the site by MP Environmental for disposal.

On October 22, 2015 a shipment of bag filters (four cubic yard boxes) from the SEE process treatment system was shipped offsite for non-hazardous disposal.

On November 23, 2015 a shipment of bag filters (four cubic yard boxes) from the SEE process treatment system was shipped offsite for non-hazardous disposal.

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20. NAPL Reuse

On April 7, 2015 a total of 12,647 gallons of stored NAPL was sent to Mesa Oil for reuse. The analysis showed that 703 gallons of the total fluid was water. The water has been subtracted from the NAPL recovery estimate.

On April 21-22, 2015 a total of 13,076 gallons of stored NAPL was sent to Mesa Oil for reuse. Analysis showed a water content between <1% to 3% or a total of 227 gallons of water. The water removed has been subtracted from the NAPL recovery estimate.

On May 7, 2015 a total of 5,722 gallons of stored NAPL was sent to Mesa Oil for reuse.

On May 21, 2015 a total of 1,400 gallons of stored NAPL was sent to Mesa Oil for reuse.

On June 24, 2015 a total of 6,771 gallons of stored NAPL was sent to Mesa Oil for reuse.

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21. Estimated Formation Water Temperature

The estimated formation water temperatures are indicated in Table 6 below. The formation water temperatures have been estimated for each MPE well by measuring the eductor liquid feed and return flow rate together with the eductor liquid feed and return temperatures. The enthalpy increase in the liquid return temperature as compared to the liquid feed stream temperature is used to provide the MPE well specific formation temperature. Estimated formation water temperatures above the boiling point likely indicate that steam is being pulled into the liquid extraction system. These estimated data for each MPE well location are used in conjunction with the extracted vapor data collected at the MPE wells to make determinations on steam breakthrough around the site. All of these data are reviewed holistically (with other site data such as the TMP data) to determine when and where steam cycling events should commence.

The location of each MPE well is also indicated in the table. Since perimeter extraction wells are expected to extract colder water from outside of the treatment zone, the formation temperature at these locations is not expected to reach steam temperatures. Thus, full or partial steam breakthrough can still be occurring at the perimeter locations without the estimated formation water temperature being at boiling. Please note that if the estimated formation water temperature is higher than 220°C for a given well, “>220” is indicated in the table.

Please note that no vapor temperature data were collected from the MPE wellheads November 5-13, 2015 due to issues with the temperature equipment.

Table 6. Estimated Well Formation Temperatures

Well	Well Location	Required to Reach Steam Temperature	Reached Steam Temperature (Calculated)	Vapor Extraction Max Temperature [°F]	Formation Temperatures 9/15/15	9/17/15	9/21/15	9/23/15	9/29/15	10/1/15	10/6/15	10/8/15	10/13/15	10/15/15	10/20/15	10/22/15	10/27/15	10/29/15	11/3/15	11/5/15	11/17/15	11/23/15	12/1/15	12/3/15
					[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]
CZ07	Perimeter	No	No	158	152		137		167	155	126	191		166	191	210	>220	211	215	138	205	93		209
CZ08	Perimeter	No	No	138	199		189		91	147	153	156		173		175	174	183	186	136	202	194	207	165
CZ09	Perimeter	No	No	105	104	103	96	138	139	159	120	124	138	144	109	120	111	112	131	100		139	141	156
CZ10	Perimeter	No	Yes	206	174		175		133	151	114	>220			65	120	123		88	111	181	197	176	188
CZ11	Interior	Yes	Yes	212									212	>220	>220	>220	>220	>220	>220	159	>220	>220	85	
CZ12	Perimeter	No	Yes	120	116	162	157	150	141	144	130		121			162	162	173	181	143		201	200	199
CZ13	Perimeter	No	Yes	160	168		>220		138	122	145	135			166	168	169	175	177	178	211	178	100	113
CZ14	Perimeter	No	Yes	112	211	198	>220	>220	>220	>220	>220	212	>220	>220	>220	>220	>220	>220	>220	197		>220	>220	189
CZ15	Interior	Yes	Yes	120		195	>220	195	98	122	121	157	113	105	200	207	>220	182	>220	168	201	210	218	213
CZ16	Perimeter	No	Yes	210	198	>220	96	>220	132	158	132	176	>220	>220	>220	>220	>220	>220	>220	203		>220		
CZ17	Perimeter	No	Yes	200	156	>220	181	136	133	148	134	144	167	186	210	210	164	189	>220	>220	176	>220	197	157
CZ18	Perimeter	No	No	100	104	126		126		126	105	122	134	103	160	133	150	158	174	160	174	105	139	
CZ19	Perimeter	No	No	110		148	115	145	134	135	135	141	152	107	181	171	169	205	178	182	181	206	180	175
CZ20	Outside CZ	No	No	111	83	92		99		97	91	100	96	98	96	95	93	90	81	91	87	88		96
LSZ01	Interior	Yes	Yes	126	113	132	174	194	194	193	186	201	189	182	193	196	>220	199	204	131		219	>220	205
LSZ02	Interior	Yes	Yes	130		>220	>220	>220	>220	191	29		213	>220	89				>220	176	>220	>220	>220	>220
LZS04	Interior	Yes	Yes	206						93														
LSZ05	Interior	Yes	Yes	220	>220	76	85	>220																
LSZ06	Interior	Yes	Yes	218	>220	>220	96	>220	>220	>220	>220	>220	>220	>220	204	>220	>220	>220	>220	196		>220	92	
LSZ08	Perimeter	No	Yes	120	107		>220		144	212	>220	208		179	>220	>220	>220	>220	>220	>220	>220	>220	>220	>220
LSZ11	Perimeter	No	Yes	119		0	104					144	121	137	129	119	123	121	124		164	215	117	118
LSZ12	Perimeter	No	No	126	171	183	168	192	192	170	168	170	175	190	186	186	187	188	188	130	193	189	167	193
LSZ13	Interior	Yes	Yes	125	179	198	220	199	205	218	196	206	218	>220	209	216	210	215	186	122	195	>220	>220	217
LSZ14	Perimeter	No	No	125	185	185	190	196	185	169	164	162	172	183	191	183	194	202	218	135	202	198	85	
LSZ15	Interior	Yes	Yes	208	>220	>220		>220		212	205	196	220	>220	219	>220						>220	>220	>220
LSZ16	Interior	Yes	Yes	205		176	107	200	160	160	152	160	170	208	193	181	187	190	183	126	186	182	172	207
LSZ17	Perimeter	No	Yes	220	98		172		120	119	109	109			129	127	119	116	115	112	115	110	103	100
LSZ28	Perimeter	No	Yes	129	177		185		0	167	150	156		174	185	184	187	190	194	100		173	170	166
LSZ29	Perimeter	No	No	116	59	195	179	190	187	184	176	189	198	185	171	186	191	206	>220	141	>220	>220	>220	>220
LSZ30	Interior	Yes	Yes	133	215	215		214		>220	198	203	218	>220	>220	>220	131	>220	>220	>220	>220	>220	>220	>220
LSZ31	Interior	Yes	Yes	147	176	188	202	208	191	175	184	>220	>220	>220	>220	>220		189	>220	150		>220	187	>220
LSZ32	Interior	Yes	Yes	120	208	163	206	195	215	202	178	192	211	213	214	>220	217	>220	>220	150	>220	>220	>220	>220
LSZ33	Perimeter	No	Yes	130	105	192	166	198	192	192	188	183	186	192	195	193	197	201	208	144	>220	>220	>220	>220
LSZ34	Interior	Yes	Yes	168	121	124	192	207	120	171	203	187	142	132	146	197	202	215	206	142	>220	>220		>220
LSZ35	Perimeter	No	Yes	121	117	116	107	133	124	127	124	124	125	124	120	127	131	126	136	126	126	134	118	194
LSZ36	Perimeter	No	Yes	128	119	193	213	207	193	192	171	171	181	189	>220	177	152		>220	189	>220	>220		152
LSZ37	Perimeter	No	Yes	208	194	200		216		176	116	113	208	>220	220	212	127	215	>220	>220	140	200		
LSZ38	Perimeter	No	Yes	116	134	175		165		161	141	176	166	128	178	195	113	>220	98		147	151	>220	
LSZ39	Perimeter	No	No	118	116	117		135		135	109	113	119	144	130	131	105	132	148	143	135			109
LSZ40	Interior	Yes	Yes	135	>220	209	>220	>220	>220	>220	210	193	>220	>220	>220	>220	>220	>220	>220	>220	>220	>220	>220	>220
LSZ42	Perimeter	No	Yes	130	102	184	166	190	194	180	184	189	187	190	193	195	200	202	201	139	>220	>220	214	205

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					Formation Temperatures																			
Well	Well	Required to Reach	Reached Steam	Vapor Extraction	9/15/15	9/17/15	9/21/15	9/23/15	9/29/15	10/1/15	10/6/15	10/8/15	10/13/15	10/15/15	10/20/15	10/22/15	10/27/15	10/29/15	11/3/15	11/5/15	11/17/15	11/23/15	12/1/15	12/3/15
	Location	Steam Temperature	Temperature (Calculated)	Max Temperature [°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]	[°F]
UWBZ01	Interior	Yes	Yes	150	>220	77	>220	68	>220	>220	>220	>220	140	>220	177	172	>220	205	201	143		>220	184	>220
UWBZ02	Interior	Yes	Yes	208	>220	165	>220	>220	>220	190	>220	>220	>220	>220	>220	>220	>220	197	84					
UWBZ04	Interior	Yes	Yes	188	145		>220		>220							205	217	39	>220	182	>220	>220	>220	154
UWBZ05	Interior	Yes	Yes	220		196	>220	>220	>220	>220	>220	>220	>220	>220	>220	214	200	196	>220	165	>220	>220		
UWBZ06	Interior	Yes	Yes	165	155	170	166	173	141	185	189	203	94	96	97	95	93	207	>220	135	0	170	>220	128
UWBZ10	Perimeter	No	Yes	179	>220		97		204	209	217	>220		>220	188	180	187	182	199	144	>220	>220	>220	199
UWBZ17	Perimeter	No	Yes	220	178		>220		162	>220	148	>220		>220	185	188	170	183	206	140	>220	>220	213	209
UWBZ18	Interior	Yes	Yes	180	>220	>220	104	156	>220	180	>220	>220	>220	162	>220	>220	>220	150	>220	102	195	>220	>220	>220
UWBZ19	Perimeter	No	Yes	162	198	154	137	208	207	198	133	>220	>220	>220	209	198	94	182	187	132		>220	159	>220
UWBZ20	Dual Phase - Perimeter	No	No	112										108								187		
UWBZ21	Outside UWBZ	No	No	118	141	129	166	171	172	165	162	156	166	148	165	175	173	173	166	112	217	>220	>220	>220
UWBZ22	Perimeter	No	No	127	115	100	121	140	136	143	155	170	158	164	82	131	133	134	118	127	207	>220	162	170
UWBZ23	Outside UWBZ	No	Yes	131	62	>220	214	219	215	171	214	215	>220	>220	>220	218	208	213	212	146	>220	>220	178	>220
UWBZ24	Dual Phase - Perimeter	No	No	190		154	110	125	150	111	140	139	155		106	95	94		95	30	>220		212	>220
UWBZ26	Outside UWBZ	No	No	105	122	122		128		123	116	131	123	134	116	133	100	116	130	112	131	130		130
UWBZ27	Outside UWBZ	No	Yes	115	89	201		>220		165	210	191	>220	>220	>220	>220	105	>220	>220	216	215			115

RED	: at or above steam temperature (≥210 °F)
GREEN	: below steam temperature (<210 °F)

22. NAPL Screening Results and Calculated Benzene Concentrations

Figures 27-29 below present the screening level results for NAPL detected in samples collected from MPE wells across the site. Screening samples are typically collected on a weekly basis. The figures below also include calculated benzene concentrations of groundwater samples collected from MPE wells across the site.

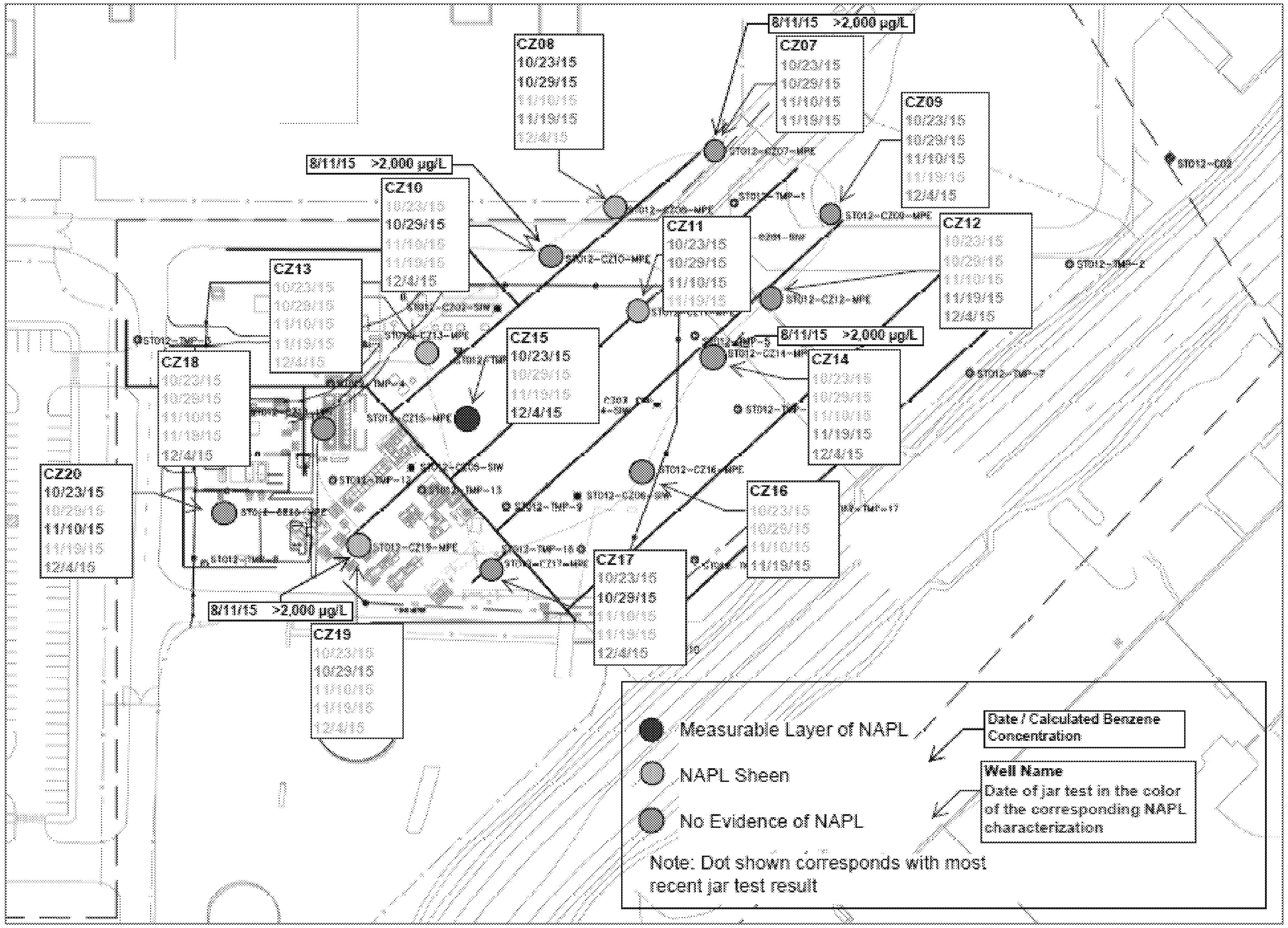

Figure 27. NAPL Screening Results and Calculated Benzene Concentrations – Cobble Zone

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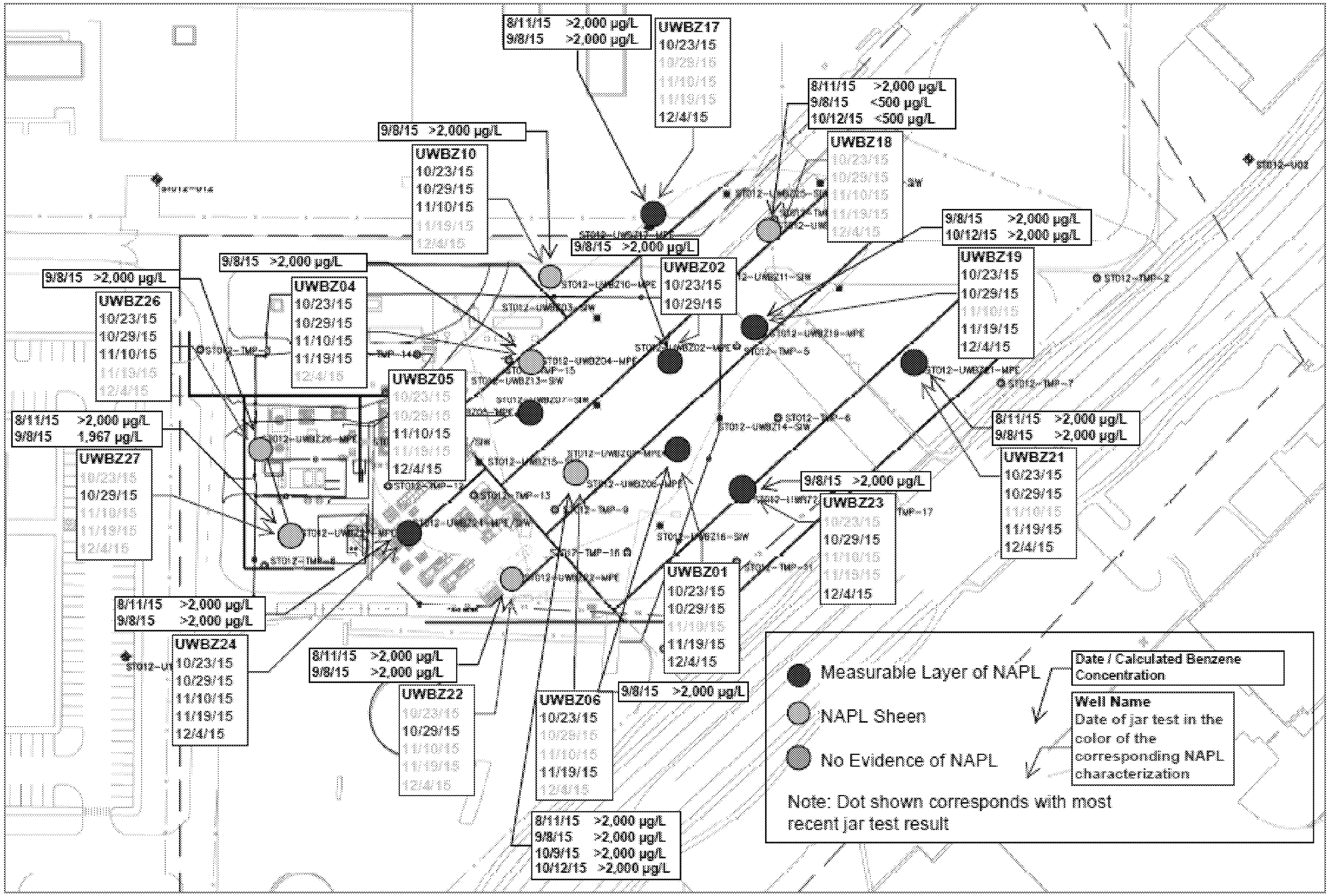

Figure 28. NAPL Screening Results and Calculated Benzene Concentrations – Upper Water Bearing Zone

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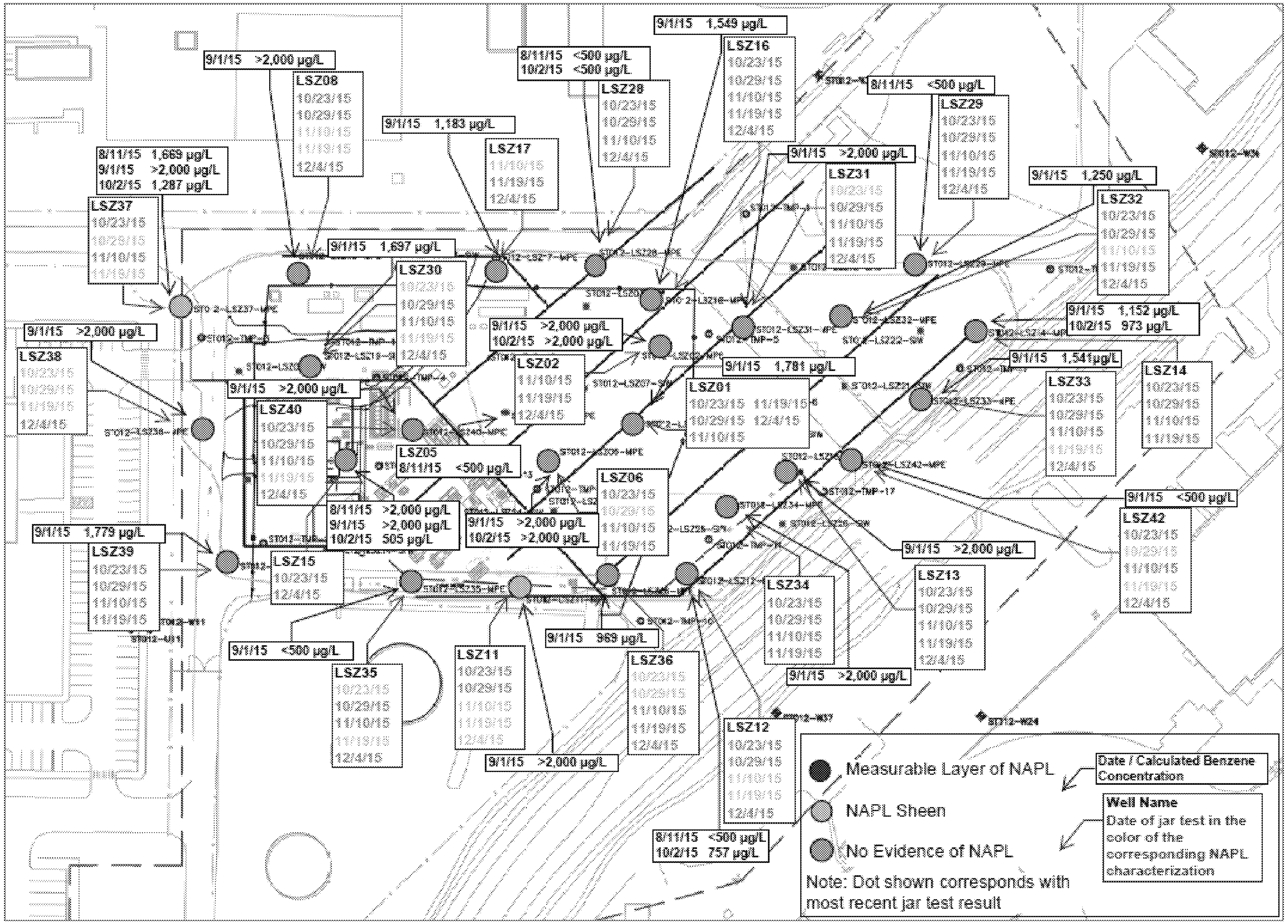

Figure 29. NAPL Screening Results and Calculated Benzene Concentrations – Lower Saturated Zone

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